THE

MINING AND SMELTING MAGAZINE:

A MONTHLY REVIEW OF

PRACTICAL MINING, QUARRYING, & METALLURGY,

AND

Record of the Mining and Metal Markets.

EDITED BY

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PREFACE.

In concluding the First Volume of the "Mining and Smelting Magazine," the Editor is conscious of many shortcomings. To a great extent these were unavoidable in the commencement of a periodical of this description, and only to be overcome by experience. He hopes henceforth to make the Magazine in every way worthy of the kind aid and liberal patronage he has received from almost all connected with mining and metallurgy, whose aid and patronage are most valuable.

London, June, 1862.

THE

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JANUARY, 1862.

The History and Present Position of the British Coal Trade.

By EDWARD HULL, B.A., F.G.S.,

Of the Geological Survey of Great Britain: Author of "The Coal Fields of Great Britain."

WE shall here present our readers with a short sketch of the rise and progress of the production of coal—as introductory to a series of special articles on each of our great coal fields, which we hope to furnish from time to time.

The subject, it must be allowed, is one of deep interest and importance, whether we consider the number of persons at present employed directly and remotely in raising and transporting the mineral, the amount of capital invested in collieries, and the universal application of coal to domestic and manufacturing purposes, as well as for smelting ores and propelling machinery. Indeed, so varied are the uses of coal, that, deprived of its aid, we can scarcely conceive any other result than that art, science, manufactures, and society itself would be brought to a dead stand. We may, it is true, believe that other forces of nature would, in such a case, be called into action, where now they are dormant; that heat might be evolved from air, water, and other sources. However, we have to deal with our social economy as it now exists; and seeing how largely it is dependent upon the supply of mineral fuel, it becomes of importance to discover to what extent we may look forward to its supply for future years. A well-founded knowledge of the resources of our coal fields will tend to prevent a repetition, on the one hand of such panics, and, on the other, possibly over confident assurances, to which the nation has lately been a witness. It certainly becomes the statesmen of a great nation to investigate to what extent they may count upon the supply of a mineral essential to our commercial greatness and political ascendency, yet in itself of limited distribution, and which when once consumed is for ever lost. With these preliminary remarks we proceed to the subject more immediately before us.

If we are to place reliance on the evidence of stone-headed implements found in excavations in South Wales, Leicestershire, and elsewhere, it would seem that coal-mining had its commencement in very early pre-historic times. The existence of cinder heaps in the north of England in and about Roman stations, leads us to suppose that the Roman conquerors of Britain were not unacquainted with the uses of coal as a fuel, though we have no documentary evidence of the fact. In addition, however, to the positive evidence here referred to, it seems improbable that the natural out-cropping of beds of coal on the banks of rivers and hill sides should have failed to attract the notice—and stimulate the curiosity—of a people so generally observant and enterprising.

The first historical notice of the use of coal for domestic purposes is the solitary one in the Saxon Chronicle (A.D. 852), in which the mineral is referred to under the term "græfan." Whether this is the earliest term applied to coal, or whether the Celtic name "glo" is of earlier date, must remain a matter for conjecture; yet there is every probability that the mineral was extracted from its bed amongst the hills of South and North Wales at a period quite as far back as that of the Anglo-Saxon kings.

Before we again meet with reference to this subject we have to pass over several centuries to the reign of Henry II. At this time are recorded the two well-known passages in the Boldon Book, in the year 1183. In the year 1259 we find the first public recognition of coal as an article of commerce, and from the charter of Henry III. to the freemen of Newcastle-on-Tyne we may date the foundation of our coal-trade. From this time, Newcastle began to pour into the London market an ever-increasing supply from the great northern coal-field; which, in the year 1860, reached the large amount of 1,347,574 tons. In succeeding years we find frequent references to coal-produce;* and it is probable that during the 14th and 15th centuries mining became general in most, if not all, of the coal-fields of Britain. In the reign of Queen Elizabeth the trade flourished; but it received a check from monopolies and taxation during the time of Charles I., until relieved by the interference of Parliament.

We are indebted to Campbell for the first statistical accounts of the quantity of coal raised in Britain. The quantity raised in 1670 was 200,000 chaldrons, which sold at seventeen shillings† a chaldron; in 1690 upwards of 300,000 chaldrons, and in 1760, 600,000 chaldrons were annually consumed. The production constantly increased till, at the commencement of the present century, it reached about ten millions of tons. In 1819 the production has been estimated by Mr. R. C. Taylor to have reached 13 millions. In 1840, the quantity raised, as estimated by Mr. M'Culloch, was 40 millions. Passing on to the year 1854, in which the first volume of the *Mineral Statistics of Great Britain* was issued by Mr. R. Hunt, and in which we have,

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* See, Matthew Paris's *History*, 1245; Leland's *Itinerary*, vol. viii.; Surtee's *History of Durham*, vol. iii. p. 396; Ænei Sylvii *Opera*. p. 443, where mention is made of mining in Scotland in the 14th century; Pennant's *Tour in Wales*, vol. i.

† This sum in our time would be equal to at least 30 shillings current.

therefore, the first authoritative information on the subject, we find the production for Great Britain and Ireland, in that year*, set down at 64,661,401. Henceforth, the yearly issue of the Mineral Statistics puts us in possession of reliable information, collected under the auspices of government, on the produce of Great Britain and Ireland; and the following summary for each year up to 1860 shows that this great branch of British industry has been undergoing a steady, though variable, expansion.

Coal raised in Great Britain and Ireland from 1854 *to* 1860.

		Tons.
1854	England and Wales	57,064,651
	Scotland	7,448,000
	Ireland	148,750
	Total	64,661,401
1855	England and Wales	56,983,450
	Scotland	7,325,000
	Ireland	144,620
	Total	64,453,070
1856	England and Wales	59,008,815
	Scotland	7,500,000
	Ireland	136,635
	Total	66,645,450
1857	England and Wales	57,062,604
	Scotland	8,211,472
	Ireland	102,630
	Total	65,376,706
1858	England and Wales	55,961,650
	Scotland	8,926,249
	Ireland	120,750
	Total	65,008,649
1859	England and Wales	61,559,465
	Scotland	10,300,000
	Ireland	120,300
	Total	71,979,765

* The produce of Ireland for this year is so small as compared with Great Britain (148,750 tons) that the total amount would not be materially altered by subtracting it.

1860	England and Wales	69,022,773
	Scotland	10,900,500
	Ireland	119,425
	Total	80,042,698

To the above ought to be added, on account of waste on fire-heaps, at least 4,000,000 tons; making a grand total of 84 millions of tons during the past year. In the same period the number of collieries in the United Kingdom has increased from 2,397 in 1854 to 3,009 in 1860. This great drain upon our coal-fields has, in all probability, by no means approached its maximum. With a constantly increasing population, the expansion of the iron trade, and of manufacturing industry; the gradual substitution of steam vessels for sailing ships, in our navy and mercantile marine, and the increase in our export trade, we may look forward to a much larger production than has been yet attained. It is not improbable that the present generation may witness that amount reaching one hundred millions of tons annually.

Such an event will not be considered impossible by those well acquainted with the structure and capabilities of our coal-fields. While in a few limited districts,—such as those of Flintshire, Coalbrook Dale, South Staffordshire, and others,—the coal is being rapidly exhausted, the majority of the coal-fields are by no means as yet fully developed. This is especially the case with regard to the South Wales, Denbighshire, North Staffordshire, and Yorkshire coal-fields, which are capable, without any extraordinary drain, of yielding from 10 to 20 per cent. over their present production. We shall not, however, now pursue this subject further, as we may have occasion to return to it at some future time.

Chapters on the Methods of Working and Ventilating Coal Mines.

By Mark Fryar, F.G.S.,
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CHAPTER I.

The various methods pursued in working and ventilating coal mines have often been discussed, upon the reading of papers at meetings of mining engineers. A few books have likewise been written on the subject; and communications to public journals have also occasionally described local peculiarities in the operation of coal "getting," and, more frequently, have entered upon the merits or demerits of plans of ventilation, and the various means of producing ventilating currents. But hitherto no attempt has been made in the English language, to

bring into a consecutive form all that may be said on these important departments of mining, as they stand related to each other, and in their bearing separately upon the economy and safety of all coal mining works.

There must always—even in the earliest times—have been some general plan of work decided upon, and carried out, in conducting mining operations, whether derived from one or more directing minds, or being merely the result of rude deliberations and discussions—or even the unconscious experience—of workmen themselves. The primary object of these plans would necessarily be the economy of work, and the safety of the labourer,—however rude might have been the design, or however recklessly it may have been carried into effect. Still one can easily imagine, that considerable confusion and uncertainty of method would characterise the first attempts at coal mining, and that a tolerably well defined system of work could only arise out of considerable experience in the art, and after it had become necessary to sink shafts to the depth of many fathoms.

There is indeed one great difference between the motives influencing the primitive and modern miner in the economy of coal getting. A century or two ago, the total annual production of the country scarcely equalled the out-put of half a dozen of our largest collieries at the present day. With such a limited production, compared with seemingly boundless resources, it is not surprising, or indeed very blameable, if the miners of those days conducted their operations in the most wasteful manner, caring not how much of the coal—seemingly so inexhaustible—was lost, provided the portion saved was got at a low rate. The present total annual produce of British coal mines equals a seam of coal one yard in thickness and thirty square miles in area; and the advanced state of geological science has approximately made known to us the probable area of country in which coal exists at a workable depth. The limits of this area are certainly found to be wider than was formerly supposed, and to extend beyond those measures in which coal seams have already been proved by actual workings. Still the resources, great as they undoubtedly are, are *limited*—particularly within moderate depths;—and therefore, while the modern miner knows that a *small coal field* is being consumed every year, he is also aware that the quantity of coal still available, although enormous, has yet a limit, which he knows with a tolerable degree of accuracy. The primitive miner, in his ignorance, might have been fairly contented with a *portion* of the coal of each pit; the modern miner, with his present knowledge, should not, in justice to futurity, be content with less than the *whole of the coal* from each pit, apart from, and irrespective of, any immediate benefit arising from increased production.

Coal-mining is now rapidly increasing in difficulty and danger, owing to the greater depth at which coals are being worked, and, as a consequence, the greater extent to which explorations are being proceeded with from one or two shafts. The attention to economy and safety, which has always been required in mining operations in a special degree, ought therefore, at the present time, to be more than redoubled. Every means, consequently, of accurately determining, and widely disseminating, a correct knowledge of the expe-

rience of the past, and of the practically useful and profitable innovations of the present, should be made as available as possible to all mine-managers, captains, and overmen, and to every workman who has the ambition to raise himself into a higher position in connection with his calling. The mining engineer, of whatever grade he may be, is required to be steady, intelligent, and ingenious; full of energy and perseverance; cautious about novelties, and yet without prejudice against any thing simply because it is new.

To enter upon a minute description of the geology of the "coal measures" would be simply delaying the information which these chapters are intended to convey, and I must therefore assume that the reader has already made himself familiar with the prominent features of this preliminary portion of the study of coal-mining. I may, however, just remind him of the geological position in which coal is generally found. The principal beds or seams occur, in this country, in what is called the *carboniferous system;* this being a name given to a series of rock strata, owing to a large number of coal seams being found associated with them. The *coal measures* are alternations of coal-beds, bands of iron-stone, layers of clay-shale, siliceous gritty rocks, and of sand-stone; and in some places, as in the Scotch coal field, of beds of limestone. These form the upper portion or "formation" of the carboniferous system; the millstone grit and carboniferous limestone forming the two other formations of the system in a descending order. In Scotland this geological system divides itself into—upper coal measures; carboniferous limestone; and lower coal measures: the representative of the millstone grit not being certainly known, and the carboniferous limestone being to some extent interstratified with the coal measures.

The thickness of seams of coal is very variable, ranging from a few inches up to nearly 100 feet. The inclination is also equally variable in its amount, the beds being sometimes nearly flat, and at other times almost vertical: between these two extremes well nigh every angle of inclination is to be met with. Coal is consequently worked at all depths: in some places it may be commenced with at the surface; and at others, pits have to be sunk for it to a depth of upwards of 600 yards (more than one-third of a mile.) It is therefore evident, from the varying inclination of coal-seams, and the different depths at which they are wrought, that the methods pursued in working them must similarly differ from each other. Besides these main circumstances of dip or depth, there are several other local conditions which require to be very carefully considered, in deciding what system of working may be most economically and safely adopted. These I shall refer to in the following order:—

I. *The texture of the coal to be worked.*

II. *The character of the rock forming the roof and floor of the coal seam.*

III. *The relative positions of two or more seams to each other.*

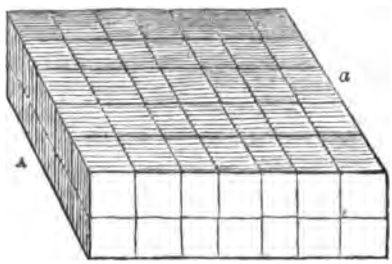
IV. *Surface conditions from under which the coal is to be worked.*

I. THE TEXTURE OF THE COAL TO BE WORKED.—It will be seen from what has already been said, that, in working out coal seams situated at considerable depths from the surface, and inclining but at

a small angle from the horizon, the weight of the overlying strata is the chief matter to be dealt with. If the whole of the overlying mass of rock can be removed, and the coal wrought by opencast, the working becomes exceedingly simple, being nothing more than quarrying out the coals. The difficulties associated with coal working are principally owing to the enormous weight of rock overlying it. The weight of this mass may, certainly, in some cases of hard, tough coal, be made to do a large amount of the work of hewing or excavating; but where the coal is very soft and friable, if the weight is brought on over a large area, and upon long working faces, the result will most likely be in a measure injurious, as it will crush the coal and produce a large per centage of small—which is either valueless, or worth much less in the market than it would otherwise have been.

In most coals there are distinct and systematic joint-lines running parallel to each other at various distances apart. Of these there are two sets, one of which intersects the other, either at right angles or at angles moderately oblique. In addition to these joints there are also cleavage planes, varying in distinctness, and in their cleavage properties, in different coals. This is shown by the Fig. 1, which is intended to represent a block of coal. A *a* are the "backs," and B *b* the "joints." The cleavage is indicated by the fine lines, and is parallel to the "backs." I am not aware that there occurs in any coal such a regularity of lines of fracture as is shown by the figure; but it sufficiently indicates what is meant, and is, moreover, not a *widely exaggerated* representation of the jointing and cleavage of some coals.

FIG. 1.



To these planes in the coal there are, in some degree, corresponding planes of fracture in shale roofs; or, at any rate, the leading joints in the roof are parallel to joints in the coal. The following are the names given to drivages, or working passages, in the coal which are excavated, either directly or approximately, at right angles to the cleavage planes: in the South of England they are called "Hatchings;' in the North, "Bords;" and in Scotland, "Plane-ways." The corresponding names to these, applied to the passages driven in the direction of these planes, are "Headings," "Headways," and "Endways." I may, therefore, speak generally about *three* directions in which passages or working faces may be driven, namely :—

1, At right angles to the planes of the coal;

2, In the direction of the planes; and

3, Obliquely to the planes or in any direction between 1 and 2.

I shall have to refer to these directions for drivages when speaking about the systems of working. I need not multiply words to show the importance of working coal so as to produce it in a good marketable condition; and with as little waste as possible. Very shameful, and highly culpable, waste of this valuable mineral has resulted from defective methods of working it; and this in many cases without any

advantage to either the proprietor or the lessee :—on the contrary, had the system of working pursued been such as to produce the largest possible amount of good marketable coal, the profits of the colliery would have been vastly increased.

The weight of the roof of coal seams cannot be accurately determined, or even estimated ; nor can it, under the best management, be nicely regulated in its effect upon the coal ; yet this weight, and its effect, does admit of some degree of estimation and regulation. A neglect of these points may cause a very soft friable coal to be half wasted, or crushed into a useless, small, unmarketable commodity ; or cause a very hard tough coal to cost very much more for excavating than it would have done by a method of working which took the weight of the roof into consideration. The laminated or schistose coal, is more likely to be much broken by an excess of pressure from the roof than the massive, rhombohedral or cubical variety ; but there is a soft, easily pulverised coal which will suffer a still greater deterioration from the crushing strain of the roof than any other kind. On account of these differences, great care should be exercised in selecting the method of working best suited to the respective properties of the coal to be wrought.

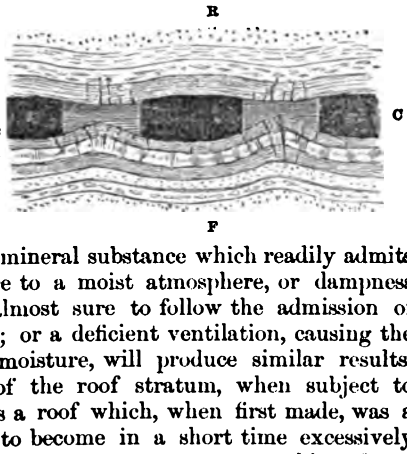
The structure of the seam or bed requires, therefore, to be well considered before deciding upon the adoption of any system of working. And this has always been a matter of anxious attention among practical coal-miners : studying the "backs" is an old expression, well understood by some of the most experienced colliers; and "*the way she works best*," or the comparative advantages of working "Bordways," "Headways," or "Crosscut," is a subject of frequent discussion among the pitmen of the Newcastle-upon-Tyne districts. A thorough knowledge of this subject is of immense practical importance to the hewer, and its careful study is of the greatest moment in carrying out, with the best economy, the operations of coal mining. "On the plane," "on the End" and "half plane" are corresponding expressions well understood by the pit-men North of the Tweed ; and "Hatching," "Heading" and half "Hatching," are terms of similar import used by the miners of South Wales and Bristol. A consideration of the probable geological causes under which joints and planes of fracture have originated, would lead one to anticipate what is found to be actually the case : that is, that the condition of these structures would vary greatly within narrow limits. This in practice is found to be so, for in some instances, even in the same seam of coal and in the same pit, one part is found to work much better by driving the principal working faces across the plane of the coal; while in another part, the advantage is gained by carrying these faces in the direction of the plane. The colliery manager should therefore be constantly on the alert for any appearance of change in the structure of the seam, and adapt the position of the line of working to suit the run of the principal joints.

II. THE CHARACTER OF THE ROCK FORMING THE ROOF AND FLOOR OF THE COAL SEAM.—Since the management of the superincumbent strata forms the chief difficulty in the working of seams of coal, it almost necessarily follows that any difference in the composition, *structure* (or of the character in any way) of these strata, especially

such as lie immediately upon the coal, will either lessen or increase this difficulty; and that the adoption of certain special methods of working must be in intimate relation with the character of these strata. If the roof consists of any broken shale, or of several feet of any kind of loose rock, the difficulty and expense of supporting it in the main passage, and in the working places of the mine, will necessarily be very considerable; and, to lessen this as much as may be practicable, the mode of working pursued should be such as will require the least number of passages, and consequently the smallest quantity of standing timber, or other means of support likely to incur constant expense. The character of the roof may be considered as being mainly of three classes, namely:—1st, a very broken friable shale; 2nd, a moderately firm roof, but consisting of several beds of shale, or of tough siliceous grits containing many threads or slips, where breakage easily takes place; and 3rd, a compact, sound roof, which will stand over very large areas without any means of support after all the coal has been worked away from under it. It is very evident that these different classes of roof will require distinct modes of working, so as to reduce the cost and the possibility of accidents to a *minimum*.

In most cases there are a few feet of soft fire clay forming the floor of coal seams, and when the weight of the rock-mass above the seam is put in motion by working away a portion of the coal, it causes the floor to rise up, producing what in some colliery districts is technically called the "Creep." See fig. 2, where C indicates the coal, R the roof, and F the floor raised up by the weight of the roof upon the coal. If the rock forming the floor contains any carbonate of lime, or indeed any mineral substance which readily admits of decomposition from exposure to a moist atmosphere, or dampness of any kind, the "Creep" is almost sure to follow the admission of water into the working places; or a deficient ventilation, causing the air to become saturated with moisture, will produce similar results. A like mineral composition of the roof stratum, when subject to similar conditions, often causes a roof which, when first made, was a very good and favourable one, to become in a short time excessively troublesome and expensive. It is no very uncommon thing for a seam of coal a few inches in thickness to occur a little way above the main workable seam; and from this and other coaly portions of the roof, or from bituminous shale, large quantities of gas are often produced. The make of gas from these sources, especially if accompanied with a little water, or even merely dampness, invariably causes a bad, troublesome roof. It is somewhat remarkable that by draining off gas and water from a district of virgin coal by exploring drifts, the roof, however bad it may have been in the first drivages, is commonly found to be wonderfully improved in the ordinary working places following the exploring operations: indeed, in a pair of

FIG. 2.



exploring drifts, it has been found that when both were kept up to the same line of advancement the roof in both drifts has been badly broken and loose, and very difficult and expensive to maintain; but that when one drift has been kept several yards in advance of the other the advanced one has had a bad roof, requiring close timbering, while the rear one has had a roof sound and safe, and not requiring a single prop. In addition to the decomposition of carbonates already noticed, intense, and often extensive chemical action frequently takes place in the decomposition of iron pyrites contained in the roof, or in the coal bed itself, by which sulphates of iron and sulphates of alumina are produced. Where this is liable to take place to such an extent as to set fire to the coal by the heat, the method of working should be so arranged as to leave nothing behind in the back mine, or waste, but what is valueless, and consequently need not again be sought after.

III. THE RELATIVE POSITIONS OF TWO OR MORE SEAMS TO EACH OTHER.—Two, and sometimes three or more coal beds are situated so closely together, that the working of one must be preparatory to working the others. Where only a few inches, or, at most, a few feet separate one seam from another, the working of the several beds will be proceeded with as if they were together forming one thick seam;—the separating shale would of course make some difference, but the leading points in the methods of working would be the same in both cases. Where the intervening shale is several fathoms in thickness, it then becomes a question of importance to consider whether the upper or lower coal should be worked first. In deciding this question, the following particular points should be considered,—although it must always be borne in mind that, in many cases, this question can only be decided by direct experience, which, indeed, in all cases, is the most safe and satisfactory means. These points are: 1st. The character and thickness of the intervening rock, and the thickness of the lower seam, as indicating whether the separating strata, in settling down—after first working the under coal—is likely to break up to the seam above. 2nd. If fire-damp is produced in large quantities by working the lower seam, how far this may interfere with the safe and economical working of the upper one. 3rd. Supposing water to be liberated from the roof by working an upper seam, in what degree may this be expected to increase the danger and difficulty of working the under one. 4th. The structure and tenacity of the respective seams must also be taken into account; for, by working an under seam, if that next above it be friable, the latter may be so crushed as to cause much waste in working it, and materially lessen its ultimate value; while if, on the other hand, it be a hard seam, working the one below it may facilitate its extraction without increasing the danger to the workmen. From experiments made by George Elliott at the Usworth Colliery, Durham, it appeared that working an under seam lessened the working expenses of an upper one, in one part of the pit; while, in another part of the same pit, and on the same seams, the contrary was found to be the case. It is therefore evident that in some cases it may be advisable to work an upper seam first, while in others the greatest ultimate advantage *will be* gained by first working the under one. Thousands of tons of

coal are wasted, and many thousands of pounds uselessly thrown away by inattention to this subject; or, at any rate, by not carefully and practically investigating it. Owners of estates containing workable coal beds would find it greatly to their advantage to keep a stricter supervision by competent engineers over the operations of their lessees than is customary in many cases. Thousands of acres of good workable coal seams have been ruined by the lessee working the best seams first, regardless of the ultimate loss sustained by the owner. The waste of so much of that valuable national possession, with which these islands are endowed in such a remarkable manner, is a matter demanding the serious consideration of the Government. Extravagant and wasteful modes of working, which must ultimately impoverish the national sources of wealth and prosperity, are moral transgressions upon the heritable rights of the generations to come, the penalty for which the nation must itself suffer at some future period.

IV. SURFACE CONDITIONS FROM UNDER WHICH THE COAL IS TO BE WORKED.—In working out a bed of coal, or a series of beds, over an extensive area, the strata, even from very great depths, is likely to break up to the surface, unless the space made by excavating the coal is closely built up, or "packed," with some kind of material,—as the broken rock from the roof, or the refuse rubbish made in hewing the coal. The effect of such a break up is frequently to admit the surface water to the workings of the mine, or damage the buildings or other constructions at the surface. Indeed, even where the space can be closely packed, it would still be too great a risk to work away *all the coal* from under a sea, lake, river or any other dangerous accumulation of water; as even then there would be great danger of fractures extending from the subterranean workings to the water at the surface. By incautious proceedings under such circumstances, collieries have been for ever lost, accompanied often by great sacrifices of human life.

In all colliery districts, cases of damage to buildings, railways, bridges, &c., are constantly met with, and the question, as to whether the profits from the coal workings will more than cover surface damages caused by working it, requires, in all cases, very careful deliberation. In some places, there are large accumulations of water in the strata, several fathoms from the surface. This may be expected where the surface rocks are new red sandstone, or any kind of loosely aggregated material. Continuous feeders, or currents, may then be anticipated to issue from the top of the first stratum of rock met with in sinking the shaft, whose mineral character or lithological structure is such as to render it impervious to water. As this may be effectually dammed back in the shaft by various means, it will be necessary to pursue such a method of working the coal as shall be least likely to bring this water into the workings. The following question will present itself in this case;—whether it will be most profitable to allow this water to run into the mine, and then raise it again to the surface, or to pursue such a restricted system of working the coal as shall prevent the probability of this? The answer to such a query can only be given, to any purpose, when all the circumstances of each particular case have been fully investigated; and even then it will be frequently difficult to decide which course will produce the most economical results.

One can rarely ever compare two or more sections of pits which have been sunk, but a mile or two apart, without discovering some difference in the number, thickness, or character of the strata composing them. It therefore follows, that the way in which the strata overlying the coal breaks up to the surface, after working all the coal out from beneath it, must vary almost indefinitely. The area of the coal district excavated by one set of workings, and the number and character of the faults intersecting it, are also points of importance, which must be allowed their due share of attention in considering such a question as this.

ON THE

Processes employed in separating Wolfram from Black Tin

At East Pool Mine, Illogan, Cornwall.

A very remarkable discovery has recently been made at East Pool Mine, in the Parish of Illogan, between the towns of Redruth and Camborne. A metalliferous deposit of a very peculiar form, and mixed character, has been met with on the lode (which had been worked in killas) coming down into contact with one of the underground bosses of granite which, in this district, are found to run parallel to the Carn Brea range. This deposit, which has the characteristics of what miners call "a floor," is made up of copper-pyrites, wolfram, and oxide of tin, often mixed most intimately together: indeed, the intimacy of the mixture greatly interferes with the commercial value of the deposit, from the extreme difficulty of separating the different minerals.

This is particularly the case with the tin and wolfram, which are so closely mixed together in the stone that only a very partial separation can be effected by the most careful spalling and picking. After stamping, it is scarcely necessary to say that a separation, by any mechanical process, is impossible, in consequence of the specific gravity of both minerals being nearly the same.

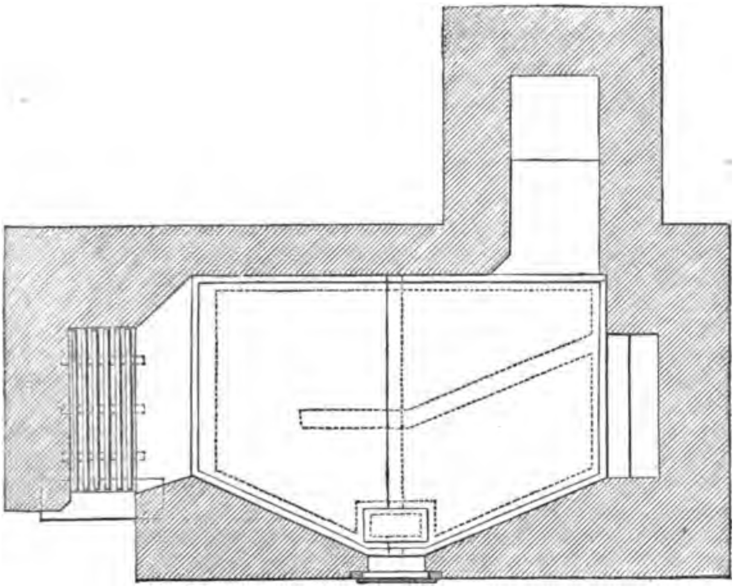
The system adopted at East Pool for separating these two minerals is the chemical one, best known as Oxland's process, from having been patented, in 1847, by Mr. Robert Oxland, of Plymouth. The theory of this process is very simple. The ore, or "work," consisting of a mixture of black tin and wolfram, is mixed with common alkali, or "soda ash," and treated in a furnace at a red heat. In this operation the wolfram is decomposed, and a soluble salt (tungstate of soda) with oxides of iron and manganese, formed in its place. Theoretically, these products are easily separated from the oxide of tin; but, practically, as will be seen by following the details of the operations at East Pool, this is far from being the case, in that mine at least.

The first operation is to clean the work by the usual mechanical processes of dressing, which separate the ganguey matters; and also by the quasi-metallurgical operation of calcining, which so decomposes the

copper and iron pyrites as to render them easily separated by subsequent washing. When the tin-stuff is thus dressed, so that, under ordinary circumstances, it would be fit for the smelting-house, it is found, at East Pool, to contain from 50 to 75 per cent. of wolfram. This is technically called "wolfram witts," and is ready for treatment by Oxland's process.

The furnace in which this treatment takes place is shown in the three accompanying figures. Fig. 1 is a ground plan; fig. 2 a section

FIG. 1.



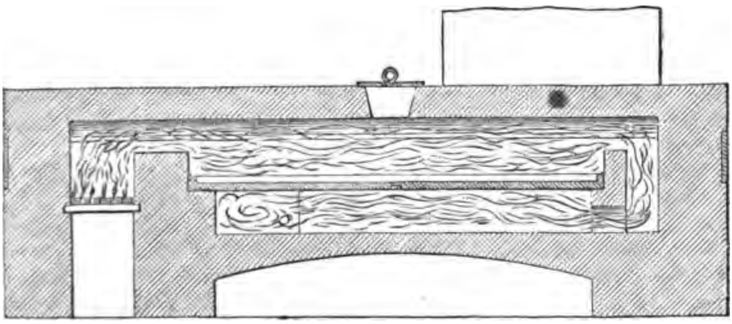
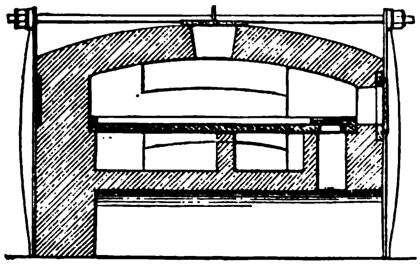


FIG. 2.

along the length of the furnace; and fig. 3 a section across it. These figures sufficiently explain themselves to make a detailed written description unnecessary; but it may be well to point out that the "sole" or "bottom" of the furnace, shown in section in figs. 2 and 3, consists of

cast-iron plate, cast in two pieces, 3 inches thick, each weighing about 30 cwt. The joining of these plates, across the breadth of the furnace, is shown in fig. 2. The same figure also shows how the fire passes, from the fire-place, first over this plate, and then, passing below, again circulates forth and back beneath it before arriving at the flue. The furnace is charged by the top hole shown in figs. 2 and 3, and the charge withdrawn through the hole in the plate shown in figs. 1 and 3. It may be remarked, that the brick top of the furnace has to be taken down and rebuilt when the iron bottom has to be removed and replaced.

FIG. 3.



The alkaline matter used at East Pool is "soda-ash," guaranteed to contain 48 per cent. of alkali, and supplied by the St. Helen's Alkali Company, at £9. 5*s.* per ton, delivered in Liverpool. The freight and carriage thence to the mine is about 20*s.*; bringing the cost, on the floors, to about £10. 5*s.*

The following are the details of the process, which differ considerably, in many respects, from that originally suggested by Mr. Oxland. As the success of the process depends materially upon small details, we have given them with considerable minuteness.

1. Light fire, and make furnace as hot as possible. It is of considerable practical importance to do this *before* putting in the charge.

2. Weigh the charge of "wolfram witts." The weight of this charge should vary according to the greater or less fineness or coarseness of the grain of the witts; the greater weight being used in the case of the rougher work. This weight ranges from 6 cwt. to 9 cwt.; the smaller quantity only being used in the case of very fine work, while the larger quantity may be employed in the case of rough grained work.

3. This charge is then put in the furnace *without* the soda-ash, and made as hot as possible alone. It is important to observe this detail, for the practice of mixing the alkali and witts together before introducing them is found to fail.

4. Weigh the charge of soda-ash. This varies with the quantity of wolfram in the witts, ranging from 9 lb. to 12 lb. per cwt.

5. The charge of witts being previously made red-hot, introduce this charge of soda-ash. When first introduced, it should be spread over the surface of the witts *without mixing*, which is easily accomplished, from its greatly inferior specific gravity. When the whole has been heated, then mix them thoroughly together.

6. Immediately after this first mixing, throw one or two shovelsfull of coal over the charge at the end of the furnace furthest removed from the fire-place. It is found, from experience, that without this addition of coals, the fire in this part is not sufficient to carry out the operations successfully.

7. Treat the whole at a white heat for about six hours, stirring and thoroughly mixing it together as frequently as possible—generally, every quarter of an hour. About every half-hour during this period, additional coals must be thrown upon the charge at the far end of the furnace.

8. At the expiration of the six hours, draw off the top half of the charge; then stir remainder once more, after which it may also be drawn off.

When this charge is drawn off hot, it is in a viscous condition, but on cooling it cakes into a mass resembling hard pumice. To separate the tin from this stuff, the following troublesome, costly and wasteful operations have to be gone through:—

The stuff is broken into pieces about half the size of a man's fist, and, being mixed with about 25 per cent. of its weight of quartz-rock, broken to the same size, it is put to be stamped. The stamps used is a small water stamps of seven heads, each weighing 1 cwt., with iron bottoms, and grates. The object of mixing the quartz-rock with the furnace-product is, partly because stuff of that nature cannot be stamped alone without clogging, and partly because the quartz has a peculiar action, which is described as "cleaning off the corode" or hard crust, which seems to form around each separate particle of tin.

The stuff from the stamps is collected in the usual manner, after which it goes through the following mechanical operations: it is buddled seven times, then tossed once, and then put to the chiming keive, where, on an average, it is chimed fourteen or fifteen times. The "roughs" or "crazes" require stamping again, sometimes two or three times (mixed again with quartzose matter), when the stamps are worked as "flashers" without grates. There is frequently, also, a proportion of the work which requires to be again treated with alkali in the furnace.

The cost of working the furnace for twenty-four hours, during which period four charges, of a gross average weight of 30 cwt., can be treated, producing, on an average, 10 cwt. of black tin, is about as follows:—

	£	s.	d.
Coal, 12 cwt.	0	10	0
Labour	0	2	3
Alkali (averaging 11 lbs. per cwt.) 330 lbs.	1	10	0
Materials	0	0	9
	£2	3	0

per 10 cwt., or £4. 6*s*. per ton of black tin.

The subsequent cost of redressing, and the necessarily large resulting loss, has not been estimated accurately; but the dressing alone is said to cost *double* as much as the original dressing. As this, on the average of the county, is £12 per ton of black tin, and as the dressing of the "tin-witts" would probably cost nearly as much as if it were wholly instead of only one-third tin, the cost of the whole operation must be enormous, and the waste proportionate. We are afraid to say what our own approximate estimate of the cost and waste amounts to.

It is impossible not to think but that there are some peculiar chemical reasons for the great difficulties met with in the separation of the oxide of tin after the treatment with alkali. If these were investigated by competent enquirers, we are convinced that some means would be found by which the present purely mechanical methods might be aided by chemical means. If so, an immense boon would be conferred on the mine in question, as well, no doubt, as upon many others, in various localities, where similar mixtures occur. Our object in preparing this article, besides that of affording a practical working description of Oxland's process, is to give such a publicity to the matter as may lead to its thorough ventilation.

We have, with this object, already placed samples of the tin-witts and the furnace-product before Dr. Percy, who has kindly undertaken to give the matter his attention. When his "Metallurgy" reaches the subject of tin, we may expect to see the results of his investigations. In the meantime, we are sure that the manager of East Pool, Captain W. S. Garby, of Redruth, will readily afford samples and information in reply to any serious enquiries.

Description of the New Form of "Fixed-Frame" in use at Cook's Kitchen, and other Mines in West Cornwall.

A NEW form of frame has recently been introduced at Cook's Kitchen Mine, near Camborne, by the manager, Capt. Charles Thomas (of Dolcoath) and the dressing agent, Capt. William Vincent; and from thence has been adopted by numerous other mines in West Cornwall.

The arrangements of this frame differ materially from the ordinary form hitherto used, where the frame is supported, on pivots, some distance above the surface, and is turned over every time it is washed. This continual turning back and forward, on the pivots, necessarily gives rise to a continued strain, tending to throw the frame out of a true level which is a necessary condition to its perfectly successful working. Where a great number of frames are employed, in the treatment of poor slimes, it results that there are either continual repairs going on, or that the frames are permitted frequently to remain in an imperfect state.

The body of this frame, drawings of which are shown in figs. 1, 2 and 3, is fixed immoveably on the ground. It is separated into any number of divisions required according to the quality of the slimes: in the drawings it is shown separated into three divisions (which is the usual arrangement), at the foot of each of which a launder is placed.

Fig. 1 shows the position of the frame while the slimes are being admitted. These are introduced from the transverse launder shown at the top of the frame, and distributed, as in a buddle, by radiating guides, equally over the top of the frame. In this position of the

frame, the "laps" over each launder are closed, so that the slimes flow continuously, from the top of the first division to the bottom of the last, into the lowest launder of all, where the tailings escape. As in the ordinary frame, the tin is arrested on each division of this frame in proportion to its quality; the best work remaining on the upper division, the next on the second, and so on.

When the slimes have flowed over the frames the necessary time—about the same as in the ordinary frame—and require to be washed down, this is readily effected by pulling up the "vibrating rod" shown in figs. 1 and 2. The upward movement of this rod reverses the

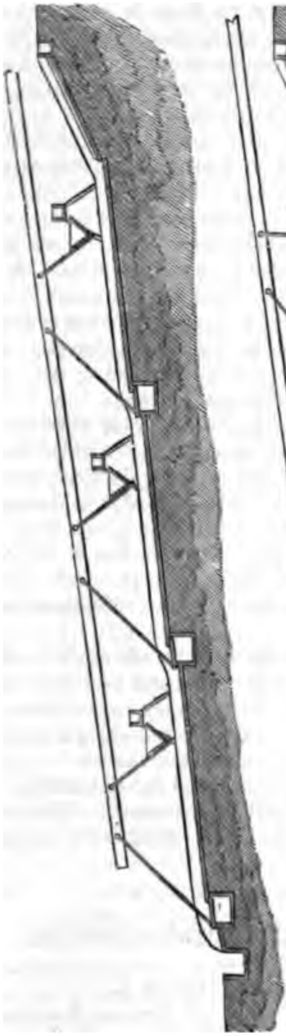


FIG. 1.

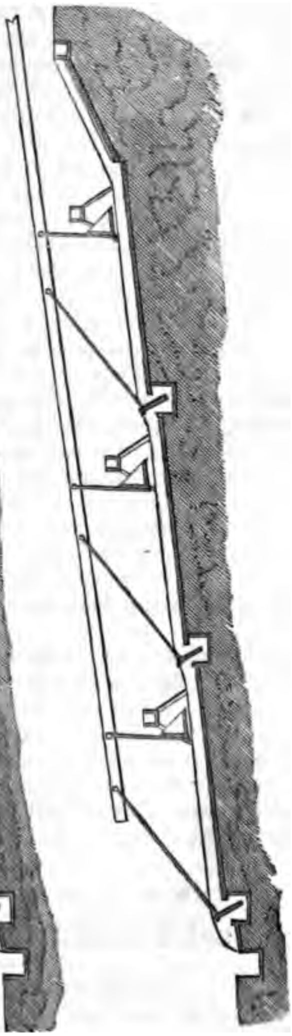


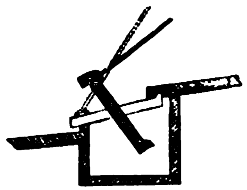
FIG. 2.
Scale 1/60th.

three saddle-back launders, suddenly emptying their contents on the top of the frame; while, at the same time, it opens the laps at the

foot of each division of the frame, by means of the connecting "expansive loop." This sudden dash of water at the head of each division of the frame, washes off its contents into the respective launders, by which they are carried to the different catch-pits. Fig. 2 shows the vibrating rod thus drawn up, the saddle-back launders reversed, and the laps open.

Fig. 3 gives, on an enlarged scale, a more detailed section of the mode in which the lap is made to close over the launder between the divisions of the frames. It was a matter of some difficulty at first to make this lap close so as to prevent some of the slime escaping into the launder: but this has been entirely obviated by adopting the details shown in fig. 3.

FIG. 3.



Scale 1/15th.

The other details are sufficiently shown in figs. 1 and 2 to dispense with any lengthened description. The saddle-back launders are supplied with water by small transverse launders, supported on brackets. The pivots of the saddle-back launders (which are put in with two screws) are also supported on these brackets. As the length of the stroke of the vibrating rod necessary to upset the contents of the saddle-back launder is much greater than that required to open the lap, the latter is connected with the rod either by means of an expansive loop or a small chain; the former being preferable, as the latter hangs loosely down when the lap is closed.

The vibrating rod can either be pulled up by the attendant girl as the frame requires washing, or it can be moved at regular intervals by a flap-jack, or any other contrivance. A flap-jack is used at Cook's Kitchen. The fall given to the frames differs to some extent at different mines: it generally varies between 1 inch and 1½ inches to the foot. In the figures the upper division has a fall of 1¼ inches per foot, and the two lower divisions 1 inch per foot. The launders conveying away the slimes from the different divisions have a fall of 1 in 6.

A considerable number of these frames—from six to twelve—are generally placed side by side in a row, and can be attended on by one girl. The mechanism is so simple that scarcely any repairs are required. The time occupied in washing down the frames also is so trifling that it is not necessary to cut off the flow of the slimes.

Of course these frames are not intended for rich work, which must be still left to be treated by the old hand-frames. They are intended to supersede machine frames for poor work now so abundant in Cornwall.

Hundt's Concave Circular Buddle.

ILLUSTRATED BY PLATE I.

THIS form of buddle was first invented four or five years ago by Herr Hundt, a mining engineer of Siegen, in Prussia. It was described in No. 26 of the *Berggeist*, and subsequently in an early

part of the *Zeitschrift für das Berg-Hutten-und Salinenwesen* for 1858, vol. v., page 65 of the *Abhandlungen*. In the following year (1859) two other papers, on the same subject, appeared in the *Zeitschrift*, showing several improvements in the details of the arrangements. From a plate accompanying one of these papers, the drawings of our Plate I. are taken. We give this plate with little alteration from the original, to show the history of the machine.

The principle on which this buddle is constructed is that of securing the largest amount of concentrating area for the "heads," and at the same time admitting of the separation of a greater proportion of the waste than can be effected in the ordinary round buddle. The latter result is due to the circumstance that the area over which the stuff has to be distributed is gradually *contracting*, thereby *increasing* the velocity of the flow, and enabling it to sweep off a proportionate quantity of the lighter matters associated with the ore.

It is due to our own countrymen, Messrs. Phillips and Darlington, and Captain William Hollow, of Providence Mines, St. Ives, Cornwall, to state that this form of buddle was conceived independently by them, subsequently to Herr Hundt, but without any knowledge of his invention. The application of the revolving distributor is, however, entirely due to Herr Hundt, and as this adds materially to the practical value of the machine, the greater part of the credit of the invention must be admitted to be due to him.

That this form of buddle is a great improvement on the old round buddle cannot, we believe, be doubted. Experiments made in Germany with lead ores have been greatly in its favour; and the success of several recently put up at Providence and other tin mines in West Cornwall is equally decisive in its favour.

Description of Plate I.

a represents the end section of an ordinary slime trommel, over the outside of which the launder *b* discharges clean water, for the purpose of keeping the holes open. *c* is the inflow slime-launder, delivering the slimes into the central trough *d*, which is fitted concentric with, and is supported by, the vertical axis *e*. This also carries the four arms *f, f, f, f*, which are connected to and revolve with the central trough. *g g* are light wooden bars (having the same inclination as the floor of the buddle) connected with the arms *f, f, f, f*, by the vertical sliding braces *h, h, h, h*, which—as in the case of the ordinary round buddle—can be raised or lowered as required by the regulating screws shown in the drawing. Attached to each of these wooden bars (*g*) is a piece of canvas *i*, serving also, as in the ordinary round buddle, to give an even surface to the work when the arms are rotating. *k* is the floor of the buddle, which has a fall, varying with the nature of the work to be operated on, from the periphery to within a certain distance of the central opening, where it is horizontal: this fall, of course, varies with the nature of the stuff to be operated on, and is best decided by experience. *l* is the central annular opening for the escape of the tails, which pass off by the launder *m*. *n* is the arbor which, moved by any convenient motive power, gives

motion to the whole apparatus—to the arms *f*, *f*, and also the diagonal distributing launders *o*, *o*, *o*, *o*. These distributing launders are in communication with the central trough *d*, from which, in their revolution, they carry the slimes to, and distribute them at, the outer edge of the buddle: they act best when they terminate with an elbow *p*, as shown in the ground-plan. These distributors, instead of being launders, may conveniently be made of light zinc piping.

The speed at which the arms and diagonal distributing launders should be made to revolve varies with the nature of the work from 8 to 16 revolutions per minute. The quantity of slimes admitted will also, of course, vary with this speed; but these are evidently matters only to be satisfactorily decided by experience.

An addition has been made in some of the buddles put up in Cornwall, of an annular sliding ring round the central opening *l*, which is raised as the tails accumulate. This addition does not appear to have been adopted in Germany; it complicates the machine, and has not been shown to possess any practical advantages which are not equally gained by making the central part of the buddle horizontal. This, however, is not a matter to be decided without further inquiry.

Mineral Statistics of India.

THE third volume of the "Memoirs of the Geological Survey of India" contains a paper dated Calcutta, 1st June, 1861, by Mr. Thomas Oldham, M.A., F.R.S., Director of the Geological Survey of India, on the coal statistics of that country. The universal interest now felt regarding the industrial progress of our great dependency cannot fail to make the information given in Mr. Oldham's paper of general interest.

Mr. Oldham prefaces his tabular statistics with the following remarks:—

"The accompanying returns give as full and complete data regarding the actual amount of coal raised throughout India generally as I have been able to procure. It is not supposed that a first attempt of this kind may be free from errors, or mistake. All that can be expected is, that all proper precautions have been taken. In this respect I may state that, with the exception of the smaller workings in the Rániganj field, the produce of which was obtained at the pits themselves, and with all possible precaution of repeated enquiry and cross-questioning, the amounts given below are those stated to me under authority of the several proprietors, agents, or secretaries of companies, &c., and these proprietors thus become responsible for the accuracy, each of his own return.

"There are still a few collieries known to be at work, from which I have not succeeded in obtaining any return. These are those at Kotah, Singrowli, &c.: but the out-turn of these is known to be small, and would not seriously affect the general result.

"The returns are given for three years past; that is, from the 1st of October or November, 1857, to the same date 1860. This is, by custom, considered the close of the 'coal year,' from the circumstance that, until recently, the only mode of conveyance for coal from the Rániganj field was by the River Damuda; and as the accounts were closed, when, after the rainy season, the river had so diminished in the amount of its waters, that there appeared no chance of sending any more coals to market that season—this period thus became the customary close of the local year.

"The total returns give an average out-turn of coal for the past three years of 87,37,454 maunds, or about 320,631 tons. But it is scarcely just to consider this as giving a fair mean of the present out-turn, for during the first of these years there

were, as is well known, disturbing causes at work tending to injure the regular trade of the country; and a fairer average, though determined by too small a number of years, will be obtained by taking the mean of the last two years' produce. This will give 100,25,020 maunds, or about 367,890 tons in the twelve months.

"The returns also show one important and interesting fact, namely, that however the local out-turn may have increased or diminished, as affected by local causes, the general out-turn has steadily and markedly increased, apparently indicating a healthy and sound extension of trade and commerce.

"The total out-turn for 1860 (that is, for the twelve months ending October, 1860) was 100,88,113 maunds, or 370,206 tons; an amount almost contemptible (about the 200th part) if compared with the wondrous total of the coals raised annually in Great Britain, viz., 72 millions of tons! but still evidencing a large and increasing commerce, and the spread of many of the arts of civilization.

"To the table a few notes have been appended, referring to other parts of the country where coal is either known not to occur, or where it may have been found in small quantities, but is not workable.

"The tables commence with the details of the Rániganj coal field, by far the most productive as well as important coal field in India, and the other localities are referred to afterwards.

The first table gives a "List of the Collieries worked in the RANIGANJ COAL FIELD during the years 1858-59-60, with Statistics of the Methods of Working employed, Out-turn of Coal, &c., &c." In this table 50 collieries are enumerated, the information and statistics respecting which are arranged in eleven columns under the following heads:—(1) *Number;* (2) *Name of Colliery;* (3) *Proprietors;* (4) *Method of Working* (by quarries or pits); (5) *Number of Pits or Quarries in work;* (6) *Date of first establishment of Colliery;* (7) *Out-turn of "Round" Coal in Maunds for the years ending September 30th,* 1858-1859-1860; (8) *Number of Steam Engines, and Horse-power;* (9) *Thickness of the Coal Seam in feet;* (10) *Thickness worked in feet;* (11) *Remarks.* The 50 collieries in this coal field are classed into the five following divisions:—

I. *Mines in the Singaran Valley,* comprising twelve collieries, worked by means of eighteen pits and ten quarries, and employing eight steam engines. The most productive concern in this division seems to be the Mangalpur colliery (Messrs. Erskine and Co., proprietors) worked by seven pits and three quarries, employing two steam engines (one of twenty-five and another of ten horse power), and producing in the year ending September 30, 1860, 1000000 maunds of round coal. In this colliery the thickness of the seam worked is 15½ feet; but the "remarks" give the following note:—"In the quarries 9 ft. of shale and inferior coal, overlying the seam, improve in quality, and are worked, making the whole 24½ ft." The Bengal Coal Company worked four collieries in this division, only one of which, however, Harispúr, turning out 440000 maunds, and employing one steam engine of twenty horse power, is worthy of notice. The East India Coal Company worked three collieries in this division, producing, in 1860, 330000 maunds, and employing two steam engines of thirty and forty horse power respectively. One of the seams worked by this company is 22 feet thick. Messrs. Nicol and Sage also worked a productive colliery, employing two steam engines (twenty-five and eight horse power), which, however, only produced 264584 maunds in 1860, against 485000 in 1859. The bed wrought in this concern is 15½ feet thick.

II. *Mines in the Neighbourhood of Ránigavj,* the most productive division in the coal field, comprising ten collieries, worked by means of twenty-five pits and fourteen quarries, and employing eleven steam engines. The most extensive concern in this division is Ránigavj colliery, commenced in 1816, worked by the Bengal Coal Company, by twelve pits, employing six steam engines (ranging from thirty-five to four horse power), and turning out 1600000 maunds in 1860 (against 1900000 in 1859). The bed wrought in this colliery is 13 feet thick. The Bengal Coal Company also work four other concerns in this division, producing together 625000

maunds. Messrs. Erskine and Co. likewise work two collieries; and the East India Coal Company one. A native proprietry (Bábú Gobind) get from two collieries the large turn-out of 1842000 maunds, employing two steam engines. In these concerns the bed of coal is 20 feet thick, all the thickness of which is worked in the quarries, but only 10 feet in the pits.

III. *Mines in the Núnia Valley, Eastern Division*, comprising thirteen collieries, wrought by means of five pits and ten quarries, employing two steam engines (of eleven and twenty-five horse power respectively). The collieries in this division are not large, only two reaching an out-turn of 100000 maunds in 1860, although others reached a higher produce in former years. Messrs. Erskine and Co. and the Bengal Coal Company appear among the proprietors; who, however, are chiefly natives. The thicknesses of the seams worked are given at 17 feet, 12 feet, 9 feet, 8 feet, and as thin as 5 feet.

IV. *Mines in the Núnia Valley, Western Division*, comprising five collieries, wrought by three quarries and five pits, employing three steam engines (of thirty-two, thirty and eighteen horse power.) Four out of the five collieries here are worked by Messrs. Apear and Co.; the most productive (Fattipúr) gives an out-turn of 150000 maunds in 1860, against 200000 in the previous year. The thickness of the seam of coal is from 10 to 12 feet.

V. *Mines in the West of the Field, and others not above specified*, comprising ten collieries, wrought by seven pits and nine quarries, employing three steam engines (of twenty, ten and eight horse power.) The principal proprietors in this division are the Bengal Coal Company, one of whose collieries turned out 329000 maunds in 1860. Messrs. Erskine and Co. also work a concern giving an out-turn of 200000 maunds; and the East India Coal Company and Messrs. Nicoll and Sage are also named as working collieries here. Among the ten collieries enumerated, six are stated to be in the Lower Damúdas, the others being in the Rániganj series. The seam varies in thickness from 35 and 33 feet (in some of the collieries in the Lower Damúdas), down to 18, 10 and 8½ feet.

GENERAL ABSTRACT OF OUT-TURN OF COLLIERIES IN THE RANIGANJ COAL FIELD.

N.B. The Ton is calculated at 27¼ Maunds.	1858.		1859.		1860.	
	Maunds.	Tons.	Maunds.	Tons.	Maunds.	Tons.
I. Singáran Valley......	878000	32220	2370600	86994	2201584	80792
II. Neighbourhood of Rániganj.........	3573000	131119	4706000	172697	4666884	171261
III. Núnia Valley (East Division)	465000	17064	680000	21284	472737	17348
IV. Ditto (West Division)	270000	9908	320000	11743	290000	10642
V. West of the Field, and others	731000	26825	873000	32036	927892	34051
	5917000	217136	8949600	324754	8559097	304094

The second table gives "A List of the Collieries worked in the RAJMAHAL "HILLS, and other places in India, during the years 1858, 1859, 1860." The Rajmahal Hills Country is divided into four groups of collieries, as follows:—

1. *Brahmini Nuddi and Neighbourhood*, comprising seven collieries, turning out altogether under 100000 maunds in 1860, the beds varying from 13 to 3 feet in thickness.

2. *Bansloi Nuddi and Neighbourhood,* comprising likewise seven collieries, giving a turn-out of only about 80000 maunds, the beds varying from 19 feet to 3 feet in thickness.

3. *Goomani Nuddi and Neighbourhood,* comprising three collieries, only two of which, belonging to Mr. Burke, are worked to any extent. These turned out 260000 maunds in 1860.

4. *North-West of Hills,* comprising also three collieries, two of which, worked by the East India Railway Company, turned out 700000 maunds in 1860.

No steam power is employed on any of the collieries of the Rajmahal Hills.

The other coal fields enumerated are—

The KURHURBARI COAL FIELD, in which two collieries are named, one worked by the East India Railway Company, employing a four horse power steam engine, giving a turn-out of 275256 maunds in 1860.

The PALAMOW COAL FIELD, in which one small quarry colliery is mentioned as worked by the Bengal Coal Company.

The KHASIA and JYNTEAH HILLS; SINGROWLI and REWAH; and SCINDE (Lynah Valley,) in all of which the extent of workings is insignificant.

The summary of all these gives the following general abstract of the coal produce of India :—

DISTRICTS.	1858.	1859.	1860.
Raniganj Coal Field	5917000	8949600	8559097
Rajmahal Hills	219000	843000	1222860
Kurhurbari	4000	108182	275256
Palamow	...	28648	30900
Sylhet Hills	22319	32498	...
Total in Maunds	6162319	9961928	10088113
Or in Tons	226140	365575	370206

Mr. Oldham concludes with the following observations :—

"Of the Singrowli coal field, which lies to the south of the River Sone, in the Rewah Territory, I have not been able to procure any return. I am, however, aware that the amount of coal raised has been small, and will not materially affect the general total. More than one bed of coal has been practically examined in the continuation of this field to the west and towards Singhpoor. But none of these are as yet at work as collieries.

"The Nerbudda Valley has long been known to contain coal, but owing to the distance from any available market, and the comparative inaccessibility of the localities where it occurs, it has not been hitherto economized. The Nerbudda Coal and Iron Company have this year commenced their operations, and I suppose will shortly be turning out coal.

"In other parts of the North-Western Provinces territory there is no known *workable* coal. Seams of lignite of very irregular size and very limited extent occur in several places along the foot of the Sub-Himalayas, marking a certain group of sandstone rocks, of comparatively recent date; but nowhere are these deposits known to be of extent rendering it probable they will ever be of any practical use.

"In Oude no coal is known to occur. In the Punjab no coal is known to occur, if we except, as above in the North-Western Provinces, the patches of lignite

which have been found in several localities along the base of the outer Himalaya, as well as in the Salt Range.

"In Scinde the only coal raised was that of Lynah Valley, as given above, but the irregularity and the small extent of this deposit has caused it to be abandoned. It was, in fact, an irregular patch of *lignite*.

"In Bombay no coal is known to occur. In Hyderabad none. In Nagpore a small coal field is known near to Umret, on the border of the Nerbudda District, which may, in fact, be considered a continuation (although actually separated) of the Nerbudda deposits. The coal is not now economized.

"In Madras no coal is known. Coal has been more than once stated to occur on the Godavery, or some of its feeders; and even very recently; but as yet nothing but black shales, which will not support combustion, and which are, in all probability, of a totally different age from the coal-bearing rocks of India, have been met with."

The following general observations, extracted from the "Friend of India," will also be read with interest:—

"Over the vast peninsula of India, which has an area of 800,000 square miles, coal is found only in the valley of the Ganges and neighbouring hills, in Rewah, to the south of the Sone, in the Nerbudda Valley, and in the Sylhet Hills, in the far north-east. There is no workable coal elsewhere in the north-western provinces; none in Oude, the Punjaub, Scinde, Bombay, or Madras. This fact is the less cheering that iron and lime are generally associated with coal in the same formation, and that India, except in the east, is comparatively destitute of these great elements and necessities of modern civilization. It is no great consolation to say that where coal exists it is abundant; that Bearbhoom, for instance, is one mass of mineral wealth. India is as large as Europe, and the coal of Raneegunge or lime of Sylhet is more useless to the cotton mills and building firms of Bombay or Madras than that of Newcastle is to Moscow. Coal is most bulky for carriage, and railway carriage will always be so expensive that it will probably be cheaper for Bombay to use good English than indifferent Bengal or even Nerbudda coal. * * * * * Our readers will form a better estimate of the coal-producing power of India, if we place in order, with the assistance of Mr. Hunt's mining records, the out-turn of all the coal countries in he world in 1857. We regret Mr. Oldham has not given the proportion of the coal area to that of the whole country:—

Countries.	Proportion of area.	Production in tons.
British Islands	1.10	66,000,000
Belgium	1.22	5,700,000
France	1.100	4,500,000
United States	2.9	4,500,000
Prussia	1.90	3,500,000
British North America	1.20	900,000
British India	......	370,000
Bohemia	1.20	300,000
Spain	1,52	250,000

Of the nine countries, India is already seventh on the list. What a future for America is involved in the fact that nearly a fourth of her whole area, as far as is investigated, is covered with coal! India raises a third more than Spain, and about the same as Warwickshire. The consumption of coal in India and by vessels leaving its ports we may estimate at 700,000 tons annually, the amount imported in 1857 from England being 329,157 tons. Reckoning the price of Indian coal in Calcutta at 5 annas a maund, or 17*s*. a ton, and English coal at the same rate (though it is far higher), we have more than £500,000 sterling spent on coal every year in India. As the trade and manufactures of India increase, and as machinery comes to be more and more largely introduced, indigenous coal will become more important. The fact that the supply is in certain districts inexhaustible, and that the demand is annually increasing, is one full of hope for the coal companies and proprietors who already occupy, or, like the Bengal Company, monopolise the field. It is possible the Nerbudda fields, worked by the company just established, may supply Bombay and the southern portions of the north-western provinces on the completion of the railway. But Oude, the Punjaub, and Madras must still look to their forests, which, on both sanitary and commercial grounds, it becomes daily of more importance to utilize and renew."

The "Standards" of Tin Ore.

To most people not intimately acquainted with Cornish mining, the system of computing the quantity of black tin in the stone, or even the mode of estimating the money value of this black tin from the "standards" fixed by the smelters, is an almost inextricable riddle. Local customs have certainly managed to involve a matter, simple enough in itself, in a very unnecessary amount of complication; as M. Moissenet very justly says—"*on arrive à introduire des complications, presque mystérieuses, là où une simple règle de trois pourrait suffire.*" As we shall continually have occasion to refer to both these points, and assume an acquaintance with them on the part of our readers, we think it advisable to give a short explanation of them. Next month we shall explain the various systems of computing the tin in the stone; confining ourselves on the present occasion to explaining the mode of estimating the money value per ton of black tin from the "standard." This is very simple. The first step is to find the "produce," which is estimated at so much in 20. This is done by trying a sample of 1 ounce = 20 dwts. in a crucible with a proper mixture of anthracite (generally about 5 dwts.) for reducing the oxide, and sometimes a certain proportion of borax for flux. The weight in dwts. of the button resulting from this assay is the "produce" of the sample—let us say 13¾ in 20 (which equals 68¾ per cent.) From this "produce" of 13¾, a fixed deduction (which remains the same whatever the produce may be) of 1¼ is made for "returning charges," which reduces the "nett produce" to 12½. The "quality" of the metallic tin is next examined into, and its class is fixed as "common" or "fine," as the case may be. A "standard" being fixed periodically by the smelters for each of these qualities, the money value is found by *multiplying the standard by the nett produce, and dividing by* 20. For example, let us take the instance assumed above of a produce of 13¾, and let us suppose that the quality of the tin was "common." We then have 13¾, less 1¼ (for retaining charges) giving the nett produce as 12½. At the time we write the standard of "common" tin is £109, to which, if we apply to above rule, we have—

$$\frac{£109 \times 12\tfrac{1}{2}}{20} = £68\ 2s.\ 6d.,\ \text{value per ton of the black tin.}$$

Besides the allowance of 1¼ for "returning charges," the smelter also receives an allowance of 3 lbs. per cwt. for "wastage;" the black tin being weighed off at 115 lbs. to the cwt., or 20 cwt. 2 qrs. 4 lbs. to the ton.

From the above data an adventurer in a tin mine is in a position at once to ascertain what his black tin should realize per ton, knowing the "produce" and quality, which he can at any time ascertain from a sample of the black tin. The two following examples may make the matter still plainer:—

With a sample of black tin, giving a produce of 13½ "common" tin, find the value per ton, the standard for common tin being £111. If from 13½ we deduct 1¼, we have 12¼ for "nett produce," which gives us—

$$\frac{£111 \times 12\tfrac{1}{4}}{20} = £67\ 19s.\ 9d.,\ \text{value per ton of black tin.}$$

With a sample of black tin, giving a produce of 13¼ "fine" tin, find the value per ton, the standard for fine tin being £114. Deducting the 1¼, we have 12 for nett produce, which gives—

$$\frac{£114 \times 12}{20} = £68\ 8s.,\ \text{value per ton of black tin.}$$

Almost all the tin ore raised in Cornwall is sold by private contract at prices calculated, by this means, from fixed standards.

List of Copper-Smelters in England and Wales;

CORRECTED TO JULY, 1861.

(From Dr. Percy's "Metallurgy.")

PROPRIETORS.	NAME OF WORKS.	LOCALITY.
Pascoe Grenfell and Sons	Middle Bank	Swansea
Ditto	Upper Bank	Ditto
Vivian and Sons	Hafod	Ditto
Ditto	Taibach	Aberavon
Williams, Foster and Co.	Morfa	Swansea
Ditto	Landore	Ditto
Ditto	Rose	Ditto
Ditto	Crown	Neath
Sims, Willyams and Co.	Llanelly	Llanelly
Copper Miners' Company	Cwmavon	Aberavon
Mona Mining Company	Mona	Amlwch
Keys and Son	Whiston	Cheadle
British and Foreign Company Newton, Keates and Co.	Parr	St. Helen's, Liverpool
Newton, Keates and Co.	Sutton	Ditto
Bibby, Sons and Co.	Ravenhead	Ditto
Mason and Elkington	Pembrey	Near Llanelly
Charles Lambert	Port Tennant	Swansea
Ditto	Widnes Dock	Liverpool
Frederick Bankart	Red Jacket	Neath
Sweetland, Tuttle and Co.	Briton Ferry	Ditto
Vivian and Williams	White Rock	Swansea
Williams and Vivians and others	Mines Royal *	Neath
James Radley	Pocket Nook	St. Helen's, Liverpool
Bold Copper Company	Bold	Ditto

* Incorporated by Royal Charter, James I., A.D. 1564.

The "Standard" of Copper-Ore, and the Associated Copper-Smelters.

(FROM DR. PERCY'S "METALLURGY.")

THE STANDARD.—The term *standard* is one in common use, but is generally quite unintelligible to persons not actually engaged in copper-smelting. For the following history of its origin, and explanation of its present meaning, I am indebted to Mr. Keates, who designates it as an "everlasting stumbling-block of copper-trade technicality."

Originally there were few copper-smelters and few miners, and it was customary for the former to contract with the latter to buy their ores for periods varying from a quarter to one year, agreeing to pay them for the same according to a *standard* price of copper determined on, and which price was usually the selling-price of *tough-cake* copper at the time. Thus,

if copper were selling at £120 per ton, the *standard* was fixed at that rate, or thereabouts. Out of this *standard* price the miner returned to the smelter a certain sum on every ton of ore sold, which for many years was fifty-five shillings per ton, though originally it was more. This was called the *returning charge*. The miner also gave the smelter 1 cwt. of ore upon every ton, to cover waste on removing the ore from the mine to the smelting-works: the smelter was also allowed a varying number of pounds of ore in each ton as compensation for moisture in the ore, the bulk being weighed *wet*, while the assayer's sample was weighed *dry*. *Examples*:—Suppose a bargain made, and the ore weighed by the miner to consist of two parcels, one of 1004 cwt., which is guessed to contain ½ cwt. of moisture per ton; the other of 800 cwt., which is guessed to contain ¾ cwt. of moisture per ton; so that in the first case the quantity of ore *paid* for is only 46 tons, 14 cwt. 1 qr., and in the second it is only 36 tons, 15 cwt. 2 qrs. Let the first parcel produce by assay 10½ per cent., and the second 5¼ per cent. of copper. In the first parcel the gross value of the copper in the ton of ore will be £12. 12*s*., the standard price of copper being £120. For 100 parts of copper (say 1 ton): £120 : : 10½ parts : £12. 12*s*. But from this gross value of the copper in the ton of ore the returning charge must be deducted. Thus, gross value of the copper, £12. 12*s*.; returning charge, £2. 15*s*.; price per ton of ore, £9. 17*s*. In like manner the price of the second parcel of ore will be found to be £3. 11*s*. Thus far the term *standard* is simple and intelligible, meaning neither more nor less than the *price of copper*.

The sources of the smelter's profits were the care with which he got his ores transported from the mine to his works, so as to save as much as possible of the 1 cwt. of ore in each ton which he did not pay for, the portion of the £2. 15*s*. returning charge which was not actually expended in smelting, and the *surplus* or quantity of copper which his furnaces yielded in excess over the crucible of the assayer; and this of course would vary with the skill as well of the assayer as of the smelter. Originally copper ores were dressed to a pretty uniform rate of produce, perhaps from 9 to 12 per cent., and, *whatever the produce*, the standard did not vary. By and by the ores were not dressed so uniformly; some came to the market, say of 15 per cent. produce, others of 5 per cent. But the smelter, more acute than his neighbours, saw that he had better buy those of 5 per cent. and leave the others, because it took a much less portion of £2. 15*s*. to smelt a ton of ore of 5 per cent. than a ton of ore of 15 per cent. produce.* Now, the simple mode of meeting this was to have had a varying scale of returning charges, instead of which these charges remained the same, while the standard was varied with the varying produce of the ores, so that, with copper at £120, there might be a standard of £115 or £130, and thus the word standard lost its former simple and correct meaning. Competition went on increasing, processes were improved, carriage, freights, coals, &c., were lowered, but the *returning charge* continued the same, with, of course, less applicability than ever to the varying produce of the ores.

An illustration of what actually occurs at a modern sale will make the matter plain. Out of a modern sale of 3,000 or 4,000 tons of ore, varying in produce from 4 to 20 per cent., let us select the following lots, with, the prices at which they were sold:—

		£	*s*.	*d*.
100 Tons of	5 per cent. produce	4	12	0
,,	8 ,, ...	8	1	0
,,	12 ,, ...	12	18	0
,,	16 ,, ...	17	8	0
,,	20 ,, ...	21	15	0

* The father of the late Mr. Vivian, it is reported, was the first person clearly to apprehend this important commercial truth.

The smelter has no longer got his *standard* price of copper arranged with the miner as of old, but he opens his eyes to all the circumstances, or ought to do; he sees what sort of ore he wants; he knows the rate of carriage and freight which he will have to incur on each parcel; he knows that one lot melts easily, another with difficulty; a third makes good copper, a fourth bad, and so on; and in the end, he finds he has bought the five lots of ore above mentioned at the prices affixed. Immediately the *prices* are disclosed in the sale room the miners' and smelters' clerks proceed to calculate *the standard* in the following manner:—

	£	s.	d.
Price of the ore of 5 per cent produce	4	12	0
Add returning charge	2	15	0
	7	7	0

But this sum refers to the *ton of ore*, or 5 per cent. of the *ton of copper*, so that the standard of the ton of copper will be £7 7s. × 20=£147.

Again:—

	£	s.	d.
Price of the ore of 20 per cent. produce	21	15	0
Add returning charge	2	15	0

This multiplied by 5 gives the standard of £122. 10*s*. Hence *the standard is now deduced from the price, and not the price from the standard, as formerly*. The buyer makes his offer without thinking of the standard. When the sale is over the *average produce* of all the parcels of ore is determined, and also the *average standard*. Taking the 5 lots enumerated, the average produce is 12 3-16 nearly, and the average standard £132. 4*s*. nearly. The only purpose which this modern standard serves is a ready mode of comparison of prices or of rates at which *copper in the ore* has been sold.* For instance, instead of saying, last week ores of 5 per cent. produce sold for such a sum, and this week they sold for such a sum, the phrase is, the standard is down a couple of pounds or up £5, as the case may be.

The Associated Copper Smelters.—There are certain of the smelting companies, about half, whose assayers act in concert and assemble weekly, when each presents the results of his assays of the samples of ores announced for sale on a given day. The assayers compare their results and agree upon a uniform list of produces, which is called the "settled list," and by this the associated smelters are supposed to be guided in their biddings for the ores. But this may not always be the case. Thus—suppose the produce of a particular lot of ore to be returned as 9¼ per cent. by the private assayer of a company while it is only fixed at 9 per cent. in the "settled list," the company would probably bid on a produce of 9¼ and *vice versâ*. Admission to this conclave of assayers is believed to be of great advantage, because the error of any individual assayer is sure to be found out and corrected. The strictest secrecy is attempted to be maintained with respect to the "settled list," both the smelters and the assayers of the association in question being under a promise not to impart information concerning their proceedings to any "outsider." The companies have, of course, a perfect right to enter into a combination of this kind, but it is questionable whether it be wise on their part to affect so much mystery, and forbid the publication of the "settled list" *after* the sale. Secrecy engenders suspicion, and people are apt to conclude that deeds are kept in the dark

* The modern standard has not even this small value at present. Miners have long since learned that, unless the produce is the same, the comparison of the nominal average standard of any two sales is no criterion of the price the ore brings; consequently we see regularly in the Cornish papers a supplemental calculation showing how the prices of ores have really gone.—Ed.

because they will not bear the light. Thus many mine-adventurers are under the impression, which may be very erroneous, that all these strict injunctions as to privacy on the part of the associated smelters can have no other object than that of keeping down the price of ores. My own conviction is, that if the "settled list" were published in due course *after* the sale, all cause of suspicion would be removed, and the association would benefit rather than suffer. It has been reported that in making out the "settled list" only the *lowest* produces are selected, and that the average of *all the produces* is not taken; but, from what I have seen, I believe this report to be without sufficient foundation. Evidence on this subject will be presented under the head of assaying in a subsequent part of this work. However, it is confidently asserted, that on one occasion good reason existed for disputing one of the produces set down in the "settled list." The following anecdote, which I received from an excellent authority, may be adduced in confirmation of this statement. Some years ago a rich copper-ore was assayed by a professional assayer of great experience, and reported by him to contain from 30 to 40 per cent. of copper. The produce, whatever it might be, was 5 per cent. higher than that in the "settled list." On the ticketing day, the particular lot of ore was presented for sale, when, on account of the discordance above mentioned, and which came to be known, a proposal was made to withdraw it. Some of the smelters present objected to this proposal, on the ground that it was not likely that the assays of their united assayers should all be wrong, and the assay of a single assayer correct. At this period, the manager of certain copper-works rose, and, with a degree of moral courage which did him honour, boldly avowed that his private assay was 4½ per cent. higher than that of the settled list. This decided the point, and its sale was postponed. It was subsequently sold at a price corresponding to the higher produce of the single assayer. I have recorded this anecdote simply to show that the "settled list" may not, in every case, be quite infallible.

Dr. Percy's Metallurgy.

Metallurgy. The Art of Extracting Metals from their Ores, and adapting them to various Purposes of Manufacture. By JOHN PERCY, M.D., F.R.S., Lecturer on Metallurgy at the Government School of Mines. Vol. I. *Fuel; Fire-clays; Copper; Zinc; Brass; &c.* London: John Murray.

(First Notice.)

THAT a country like England, occupying by far the foremost position in metallurgical industry, should up to the present time have remained without any systematic treatise on the subject, would be unaccountable in the case of any other people. But we are a "practical" people, and—a few years ago, at least—would have rather affected to despise such things; indeed, we have felt a pride, rather than otherwise, in contrasting ourselves with other nations in this respect. Without any special books or any special means of education, there seemed a grandeur in achieving such stupendous results by the mere force of industry, energy and will, and so completely distancing every other nation, notwithstanding their books and their schools.

But of late years, the competition among nations has been as keen as that among individuals. The great wealth and consequent power of this country principally springing, directly or indirectly, from her mineral industry, have excited the emulation of other nations, many of whom have shown themselves no insignificant competitors in the markets of the world. It has become necessary for us, if we are to hold our own in this industrial

contest, to neglect no means of improvement; and consequently the aid of science is now accepted willingly—indeed gratefully—where before it would have been despised. In metallurgy, this is particularly the case. For many years the most successful firms have been those who have brought science judiciously to bear in aiding their practical operations.

Hence the want of an authoritative treatise on metallurgy* has been felt for some time. But wanting a work of this kind, and even crying on the house-tops that it was one that should be written, was not enough to produce it. Let us consider the conditions essential to its being carried out successfully. In the first place, it was necessary that a man should devote no inconsiderable portion of a lifetime to the task: not that this, by any means, was the greatest difficulty. The collection of the necessary information would be the principal impediment—and one only to be overcome by some one occupying an exceptional position. A person wholly disconnected with metallurgical pursuits could scarcely expect to be allowed to penetrate its trade secrets, with no guarantee for his discretion; and, on the other hand, it would be practically out of the question for a man interested commercially in one establishment to expect to be allowed to examine into the details of others. In fact, an official position of some sort was almost necessary, as a guarantee to the smelter that the information afforded would not be used for private commercial purposes, and would be published with proper discretion. It was unreasonable to expect that, without these guarantees, the details of any business could be laid open to a stranger. As to the scientific knowledge and general ability necessary to complete such a work successfully, that would have been at any time forthcoming.

Consequently we may consider Dr. Percy's work as necessarily connected with his official position at the Government School of Mines; for although without that position he might have written a valuable work on Metallurgy, we doubt if he or any other man could have written such a volume as that now before us. Indeed, we should always bear in mind that the value of such an institution as the School of Mines is not to be measured merely by its educational results; for in maintaining a body of the most eminent scientific men in the country, devoted to the application of science to industry and the arts, we are certain to produce indirect results of almost incalculable importance.

We cannot pretend, in the space at our disposal this month, to attempt to discuss the distinctive features and opinions of this volume; we shall content ourselves, on this occasion, with giving a short summary of its contents.

As its title shows, this volume is devoted to Fuel and Fire-clays; and to the Metallurgy of Copper and Zinc, with their alloys, to which Dr. Percy limits his definition of Brass. But besides the usual introductory definitions on the properties of metals, and the principal metallurgical processes, it contains a very valuable prefatory notice on the composition and texture of slags, and the chemistry of the silicates.

Following this Introduction comes the division on Fuel, commencing with a preliminary discussion on the calorific power and calorific intensity of fuel in general. Wood, Peat and Coal (including Lignites) are successively discussed in detail; and then Charcoal and Coke—the latter at considerable length. The division on Fire-clays, and the natural refractory materials employed in the construction of crucibles, retorts, furnaces, &c., follows that on Fuel, and commences with a general enquiry into their nature and chemical composition, followed by details respecting the best known crucibles and fire-bricks.

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* We are not unmindful of Mr. J. A. Phillips' work on Metallurgy, which has been of great service; but, excepting that portion treating of the metallurgy of lead, it did not profess to speak with the authority derived from personal inquiries.

Having completed these introductory divisions we come to Metallurgy proper, opening with Copper, which is the leading article in the volume. This Dr. Percy commences with a disquisition on the general chemical relations of that metal, and its resulting physical conditions; which will undoubtedly be found one of the most valuable practical portions of his book. Following this, is an Historical Notice on Copper Smelting in Great Britain, which cannot fail to be read with great interest: in our foregoing pages we have given one or two extracts from it. A short description of the various ores of copper brings us next to the Welsh process of Copper-smelting, naturally one of the most important articles in the volume. It is divided into three parts. The *first* is purely descriptive; the *second* is more theoretical, discussing as it does the reactions which occur during the process; and the *third*, which is of very peculiar interest, treats of the Elimination of certain Foreign Metals.

After the Welsh process, we have a short, but tolerably sharp, examination of various improvements in copper-smelting, including Napier's process, Rivot and Phillips's, and Mr. Hussey Vivian's. Next, a very full description of Copper-smelting in India, Japan, Sweden, Norway, various parts of Germany and Russia—concluding with an interesting notice of the Kernel-roasting process, at Agordo, in the Venetian Alps. Following this, we have another discussion of New Processes—this time on the wet methods of extracting copper, commencing with Bankart's and ending with Henderson's. *Apropos* to some of these (we suppose) Dr. Percy makes a few observations on the patent laws, with which, we think, men of business and men of the world will cordially sympathize. That the too easy facilities granted by these laws are now grossly abused by schemers and patent-mongers, is becoming every day more and more felt.

The succeeding question, the assay of copper ores by the Cornish method, is, as Dr. Percy says, "a tender subject with copper-smelters." That this method is not accurate is, of course, beyond all question; but that the miner suffers no real wrong is equally clearly shown: "in the present day the miner would not generally receive a farthing more for his ore whatever changes might be effected in the plan of assaying"—are Dr. Percy's words: yet he is of opinion that there would be a much better understanding between Miners and Copper-smelters if ores were assayed by a more accurate method. The division of copper-smelting is concluded with some valuable details and comparisons on the commercial aspects of the subject, and with notices on copper sheathing.

The division on Zinc commences with similar preliminary enquiries as in the case of Copper; and then describes, in succession, the English, Silesian, Belgian and Carinthian processes of extracting that metal; concluding with the methods of assay.

Brass, and the alloys of copper and zinc—yellow metals—occupy the concluding pages.

This volume has been long announced, and has excited proportionate expectations. Whatever these expectations may have been, Dr. Percy has more than fulfilled them. His work not merely conveys practical information of almost inestimable value, but it conveys it in a vigorous English style worthy of a colleague of Tyndall and Huxley. There is not a trace of obscurity or scientific circumlocution; nor is there, either, the least affectation of official reserve. Indeed, many may consider that in this respect it errs in an opposite direction—but to us this frankness is its most attractive feature. Dr. Percy, in the strength of his position, can afford to call "a spade a spade;" and he is not afraid to do so, or boldly to express opinions which men of smaller calibre would almost fear to insinuate. This may subject the work to attack from those to whose interest it runs counter, but it adds immensely to its value as a candid expression of opinion from a personally disinterested observer of undoubted authority. In discussing modern inventions, Dr. Percy has often had to approach very

tender ground; and it is in the nature of things that a man so completely versed in every branch of metallurgy, ancient and modern, should have a quick eye for the weak points in proposed new processes, and be apt generally to underrate their merit, which we think he is disposed to do.

The illustrations—152 in number—are all wood-cuts, and are models of accuracy and fine work. Indeed, almost the whole of them are miniature working-drawings.

Mr. Wallace on Mineral Deposits.

The Laws which regulate the Deposition of Lead Ore in Veins; illustrated by an Examination of the Geological Structure of the Mining Districts of Alston Moor. By WILLIAM WALLACE. London: Stanford, Charing Cross.

IN more respects than one this is a remarkable book. In the first place, it is remarkable from its substance; for although the leading idea may not be new, no one has ever before sought to work it out in the detail attempted by Mr. Wallace. It is also remarkable for its style, particularly when we are aware that the author is entirely a self-educated man, sprung from the working class, who had to earn his livelihood by labour from his childhood until he attained the position of trust he has for some time occupied. And lastly, it is remarkable for the excellent—indeed, we may say, luxurious—manner in which it is got up, and for the magnificent map and plates with which it is illustrated.

Mr. Wallace starts with the proposition, in which he fortifies himself with the authority of the evidence of Mr. John Taylor before the House of Commons Committee on the Mines Rating Bill, that although the art of mining probably gave birth to geology, the latter has done little or nothing in return for mining. To use Mr. Taylor's own words, "our knowledge is not greater than that of our forefathers; the difference is simply in improved machinery." Indeed, Mr. Wallace's impression of his own district is, that there has been rather a retrogression than otherwise. "Mining in Alston Moor is a more hazardous undertaking now than formerly. * * * * Practically, the art of mining has degenerated into a mere trial-all system." There are many besides Mr. Wallace who, if they spoke what they really thought, would bear testimony to a like degeneracy in metallic mining in other districts than Alston Moor, due almost entirely to the gambling spirit in which it is pursued. In the present day we have, of course, greater mechanical appliances, and, above all, greater capital; but it is very doubtful if the old miners did not far excel us in the true art of mining—that is, finding the maximum amount of ore with the minimum amount of labour.

The author is no friend to the school of "Where it is, There it is;" nor does he belive that

It is *only* by cutting the ground
That the metal is found.

"That the deposition of metallic substances in veins, is an exception to that law and order which regulate the succession of all natural phenomena properly understood, cannot for one moment be entertained by any one thoroughly convinced of the universality and uniformity of Nature's laws." Undoubtedly not; but yet it cannot be denied that the phenomena are in the highest degree complicated—so much so, that although they have been investigated to a certain degree by many competent inquirers, none have yet been able to find any leading clue. Still there is a great deal of difference between admitting our ignorance of laws which we are satisfied exist, and which we feel it our duty to seek persistently until we discover

and sitting down complacently in our ignorance. It is our duty to inquire unceasingly, and not to do so—and above all deliberately not to do so—is, as Mr. Wallace truly says, "disastrous to the interests of practical mining." It leads, naturally, to that sinful waste which we see monthly incurred in working concerns which, to use the words of our author, "would "be considered worthless after investigations based upon general laws, "even of an empirical character."

Such is the spirit in which Mr. Wallace entered upon his inquiries; and it is one in which every well-wisher of mining must heartily sympathise. How he set about them is best described in his own words:—

"Impressed with the importance of research and careful investigations in preventing an undue expenditure in mining works, about the latter part of the year 1847 I commenced copying numerous plans of the Alston Manor, and the adjacent ones, and resurveyed carefully the whole of the Nenthead district, both internally and externally. My principal object was, if possible, to find out some particular condition, or rather phenomenon, which as the cause of ore deposits invariably co-existed with them, and thus throw some light on the distribution of lead ore in veins. I need hardly inform the student of nature that these investigations proved a total failure. They convinced me, however, of the folly of pursuing such inquiries in the mazes of experience, without any theory or guiding principle of causation.

"A few years later, I had some reasons for concluding that increased responsibilities in connection with the Nenthead mines devolved upon me. I then began to investigate the matter still more carefully, and endeavoured to look upon the phenomena connected with the rich portion, and those connected with the poor portion of the same vein, as two distinct machines, each having separate functions to perform. What these were, was the problem attempted to be solved. Whether this is done correctly or not will remain for the scientific reader to determine. The subject, however, has cost me much labour and thought; and should I not succeed in unfolding a principle of causation, and that one the most important to mining interests, I may be allowed at least the credit of collecting and arranging a large number of facts illustrating some other principle *that is true*. It may, however, be observed, that the principle of causation, which the following pages, but more particularly those of the second book, are intended to unfold, has enabled me, in most instances, to anticipate the results of trials made in the Nenthead veins in the upper beds."

Mr. Wallace adopts the rather old-fashioned arrangement of separating his work into two Books. How he proposes dividing his subject between these, we will let him describe in his own words.

"This first book of this work will relate to the geology of the district, and the laws of the formation and direction of veins. It is not designed to instruct those deeply versed in the science of physical geology; but a far more numerous class engaged with practical mining. That portion which will be devoted to veins, may serve to dispel the common error, that veins may exist anywhere, and that no principle can be discovered to guide the miner in searching for them, or lessen the hazard of his expensive explorations.

"The second book will relate chiefly to the filling up of veins with lead ore. As the most natural arrangement I intend to follow the order and succession of ideas, as gradually unfolded in my own mind. I can hardly hope that the foundation of facts, on which the reasoning (as well as the construction of the accompanying map) will depend, is in all cases free from error. These must necessarily occur, in a first attempt of this kind; and can only be removed by the suggestions of those interested in the investigations. I have, however, taken much pains to ascertain their correctness, and not unfrequently has theory, which the facts are intended to support, led to further inquiry and the correction of the latter. To delay the publication of a work of this kind until perfected, would prevent its publication altogether."

The first two chapters of the First Book—one treating "Of the Laws which have regulated the Deposition of the Mountain Limestone in Great Britain," and the other "Of the Elevation of the Rocks of Alston Moor to the position they now occupy, and the Laws which have regulated the Denudation of the Country," are almost entirely devoted to subjects which more properly belong to general geology than that special portion which it

is Mr. Wallace's object to investigate. We think, therefore, that a very large portion of them might, with advantage, have been omitted. Indeed they can only be justified on the ground that the book is professedly written, not for "those deeply versed" in geology, but for practical miners; and it is possible that Mr. Wallace's special knowledge of this class convinced him that it would not be wise to assume that they were already acquainted with the elementary geological knowledge he recapitulates in these chapters. Still the necessity is to be regretted, for a succinct view of the special features of the geology of the district might have been given more clearly in a fifth of the space; and expatiations on the well-known general geological principles of deposition and denudation are apt to be found tedious in a treatise on the deposition of lead ore in veins. It must in fairness be stated, however, that if Mr. Wallace is given to wander a little too discursively, his geology is perfectly sound—he is thoroughly imbued with the modern Lyellian philosophy of that science.

Passing over these two chapters we come to those which treat "Of the Laws which regulate the Formation and Direction of Veins." The subject is really very ably discussed, and with considerable originality; and as far as we are able to judge, the conclusions arrived at are sound. Mr. Wallace's mode of investigating and reasoning are best shown by the following extract from the 3rd chapter, which treats of the formation of veins generally.

"It is remarkable that in no case do the streams of Alston Moor flow upon or in the line of the great cross veins; nor does it appear that the existence of the latter have ever influenced even the direction of the former. The bed of the Nent river in the upper part of its course is formed upon strata elevated considerably above the same beds on the east side of Carr's vein. Above the village of Nenthead, the Nent crosses Carr's vein at an acute angle, but its direction is not in the least degree altered; and between this vein and Foreshield Burn, the direction of this stream does not vary much from a direct course, which, as pointed out in the preceding chapter, nearly corresponds with the direction of the general dip of the strata.

"It will also be observed upon the map that no stream flows upon or in the direction of the great Sulphur vein. On the contrary, in that part of its course between Duffergil and Cashburn, its existence is marked on the surface by a series of low mounds consisting of quartz mineral. It does not appear that this powerful vein has ever modified the direction of even the smallest streams. The same remarks are applicable to the east and west veins. Browngill vein—the strongest east and west vein in Alston Moor—dislocates the strata at least 80 feet. Yet no indication of this vein is found upon the surface. The hills are rounded off without any apparent modification of their outline. Generally it is only where the streams have worn a channel in the solid rock that veins appear at the surface.

"Had these powerful veins been formed at the same time that the land emerged slowly from beneath the sea, and when the principal portion of the valleys was scooped out by denudatory forces, it is not easy to conceive otherwise than that the unequal elevation of the strata consequent upon their throws, would have modified the action of those forces so as to connect the direction of the veins with certain lines of least denudation. Such, however, is not the case; no matter how great the amount of displacement of the strata, the form and outline of the hills are seldom if ever affected by it. Two questions therefore arise:—Under what conditions were they formed and at what period, with relation to other geological changes which have affected the structure of the district?"

Mr. Wallace, for the purpose of his investigation, divides the veins of the district into three distinct kinds:—

1st class, east and west veins, with a direction varying between N. 60 E. and S. 60 E. magnetic, which are generally well mineralised, and contain metallic substances when their sides are formed of any hard strata of limestone and sandstone.

2nd class, cross or north and south veins, varying less in direction than the former, and rarely containing any metallic substances (or, indeed, any vein mineral) in strata above the Great Limestone. These veins have

produced much lead ore in the Great Limestone, and both lead and copper below.

3rd class, quarter-point veins; a class of small veins, intersecting both the others, and traversing the country in two directions—one S. 55 E., and the other S. 55 W., magnetic. In the strata above the Great Limestone they contain little vein minerals, but in the strata below seemed to be filled with copper and iron pyrites.

Besides these three classes, there is another vein, the Great Sulphur Vein (sometimes attaining a width of 300 feet) which is classed *sui generis.*

In chapters four, five and six, Mr. Wallace discusses in detail the conditions of these veins, as evidencing their positive geological age, as well as their relative age between themselves, which, in our opinion, is the most successful portion of his labours. We shall allow him to describe his conclusions in his own words as to the east and west veins :—

"I trust we have satisfactorily shown that the formation and direction of the east and west veins are connected in causation with the formation of this axis (the elevatory axis of Alston Moor)—are, in fact, correlated phenomena, consequently the veins must have been in existence before the removal by denudation of the rocks which once filled up the valleys, on which we may base the hypothesis of the formation of the east and west veins having taken place before the removal of the coal measures by the currents of the sea, or by breaker action, and which enable us to conclude, with great probability, that the east and west veins were in existence when the strata were lying at a depth of at least 5,000 feet below the highest point of their present elevation."

As to the north and south, or cross, veins:

"Notwithstanding in all the instances we have adduced, the cross veins are *apparently* the intersecting and the east and west veins the intersected ones—the facts pointed out are sufficient to establish the following proposition, namely, *the cross veins in the mining district of Alston Moor were formed either anterior to or contemporaneously with the veins which traverse the district in an east and west direction.*"

As to the quarter-point veins :

"I am led to suppose that the quarter-point veins were formed posterior to the cross veins, and either contemporaneously with or anterior to those of the east and west veins. With respect to this alternative, it may be observed that the relation of veins to each other, with reference to their period of formation, can only be safely determined by careful observations of their connection with the inclination and position of the strata. It is only in the upper part of this district that I have had opportunities of studying this connection where, as observed, the veins are comparatively weak. In consequence of which I have not been able to arrive at a more definite conclusion."

This brings the First Book to a close. As Mr. Wallace concisely sums up its conclusions, theoretical and practical, in what he calls a few "concluding aphorisms," we probably cannot do better than quote them here:

"1. The strata were originally thrown down in nearly a horizontal position. This could only be effected by an equal subsidence of sea bottom throughout wide areas, and that during the whole period occupied in the deposition of the old red sandstone, mountain limestone, and coal measures.

"2. That at the close of this period, and before the Permian rocks were deposited, this vast thickness of rocks was thrown out of its horizontal position by forces of subsidence or elevation, probably the latter, and the cross veins formed, these being simply fractures parallel to lines of greatest effect produced.

"3. Afterwards the great axis of elevation, which commences at Cross Fell and extends eastward, was formed, and with it a series of east and west veins, the formation and direction of which evidently depend upon the tension the strata were subjected to by unequal elevation and the irregular bendings of this line of greatest intensity of force, as indicated by its effects. When this took place the Coal Measures had not been removed from the Millstone Grit.

"4. The denudation of the Coal Measures now took place, and also the formation of the Permian rocks, the action of the denudatory forces being regulated by the lines of greatest elevation of the rocks, the Coal Measures being entirely swept from off broad areas of country."

We now come to the Second Book, which Mr. Wallace evidently believes to embody a new philosophy. We cannot say that we quite take this view; for while we cordially admit the great value of all the facts brought forward, as well as many of the conclusions, we do not agree in considering him to succeed in at all proving his main propositions. That they represent the rudiments of some general laws which may hereafter be worked out, may be admitted; but that Mr. Wallace has succeeded in elucidating these laws we feel obliged to dispute. As valuable suggestions—as "guesses at truth"—as highly probable speculations, we are willing to receive the author's conclusions, but must enter a *caveat* against their being taken as scientifically proven.

The following extract will best show the leading idea, often indicated rather than expressed, that runs all through the author's reasoning:—

"Two theories have been proposed to assign the source from which the ore has been derived or its elements have been supplied: the one supposes it to be a segregation from the enclosing rocks, the other a sublimation from great depths and connected with volcanic influences.

"It is necessary to observe, that the laws which have regulated the distribution of the ore in the veins may be of a different character from those connected with its origination: the former may be mechanical, the latter, if the metals are substances compounded from certain elements unknown in a separate state, must be chemical. If, however, they are simple substances, which have risen to the surface as gaseous emanations from the interior of the earth, then the distribution or accumulation of the ore into certain portions of the veins may have taken place after its deposition sparsely throughout the whole extent of the fractures in the rocks. If they are derived from rocks in which their existence cannot be detected, then the compounding and localization of the ore may have been contemporaneously effected.

"If metals are compound substances, as some of the most able and ingenious chemists have supposed, then a knowledge of the process or processes by which nature has manufactured such large quantities of valuable metals would be exceedingly interesting, even in a scientific point of view alone, though it seems improbable that its use would be altogether restricted to chemical experiments or to abstract speculations, and that it should not in some form or other ultimately prove practically beneficial to the interests of man; but were we in possession of this knowledge, and had the requisite skill to produce such substances so essential to civilized life, it is questionable whether we could do so economically; it is not improbable but that we should be under the necessity of searching for them as at present by mining operations. Should this be the case, a knowledge of the laws which have regulated the distribution of the ores in the veins would even prove more valuable to the practical wants of man than the knowledge of the laws of their combination from *elements*, whether these are derived by sublimation from beneath or segregation from the rocks."

There is nothing very novel in these speculations, which, as speculations of possible contingencies, it is probably well to bear in mind. But to advance beyond this, and assume them as most probably true, and to evolve an hypothesis founded mainly on such an assumption, is travelling beyond the limits which modern science allows to theorists. There is no evidence whatever that the metallic contents of veins can be derived from their containing strata; indeed, the evidence is so much the other way—as far as our knowledge of the composition of rocks at present goes—that those who are most impressed with such a notion are driven to the speculation (which has taken such root in Mr. Wallace's mind) that many of the metals after all cannot be elements. It may of course be true; but tacitly to assume it, as is done in the beginning of the following extract, which we have printed in italics, is not justifiable:—

"*Assuming, therefore, as the more probable view of the case, that the deposition of lead ore in the veins of Alston Moor is due to segregation from, or decomposition of the rocks which form the walls of the veins where such deposits are found*, then the regulating causes must be sought for in the phenomena connected with the rich portions of the veins and enclosing rocks, and equally so in the phenomena connected with the unproductive portions. The former should be carefully studied, in order to discover, if possible, the functions they are adapted

to perform, or the natural forces they would call into action as effecting the deposition of lead ore; the latter, in order to discover their inadaptation to produce the same results."

Starting with these preconceived ideas, Mr. Wallace proceeds in Chapter 2 with his inquiry by examining the conditions connected with the productiveness and non-productiveness of the Rampgill vein, which seems to have varied very widely in different parts. We cannot follow him into the details of this inquiry, which results, however, in the following conclusion, which we again give in the author's own words:—

"We are now in a position to affirm, that the conditions connected with the very rich portion of Rampgill vein, in the Great Limestone, differ from those connected with the portion which has been very poor in this most *important particular;* that they would promote a *free* circulation of water or fluids in a longitudinal direction, *to* and likewise *in* the vein. We have already observed that the variation in amount of lead ore in the same vein and in the same stratum is greater than that of any other mineral found in veins. *The assumption is therefore warrantable, that such a variation is due in all cases to certain laws regulating the circulation of fluids, the effect of such circulation being modified by various conditions.*"

The concluding portion of the above extract, which we have printed in italics, embodies the principal hypothesis which this work is written to establish, and upon which we have already expressed our candid opinions. In chapters 3, 4 and 5, Mr. Wallace investigates (1) the laws which regulate the descent and movement of water beneath the surface; (2) the action of this water in effecting the decomposition of the rocks forming the sides of veins; and (3) its action in effecting the depositions in these veins of certain vein-minerals, such as carbonate of lime, barytes, &c. These chapters are very well done, and contain a considerable amount of interesting information, but they present no particular novelties. We are rather surprised to find that the author seems to have no acquaintance with the writings of Bischof, the great expositor of the doctrines of subterranean aqueous chemical action. Mr. Wallace quotes, often very copiously, Lucretius, the *Novum Organum* (in the original Latin), Oersted, Whewell, Cicero, Baden Powell (Unity of Worlds), John Stuart Mill, Wordsworth, Sir Thomas Browne, Thomson's "Seasons," Humboldt, Sir Humphrey Davy, Dr. Mantell, Pliny (in the original), Hugh Miller, Dr. Daubeny, Spencer's "Faerie Queen," Bacon's Essays, and other curious books—evidencing a considerable mental cultivation and a wide range of reading; but with that one author whom above all others he should have thoroughly studied, he seems to be wholly unacquainted.

In the next five chapters (6, 7, 8, 9 and 10), Mr. Wallace traces the connection between the laws of hydrous agency he has laid down, and the deposition of lead ore in the veins of the districts he treats of. That he makes out a fair case of a certain connection between deposits of lead ore and a free circulation of water in the veins we are willing to admit, but that he succeeds in establishing any general law of correlation we must deny. We have had ample evidence of the danger of pushing local experience into general hypotheses in the case of metalliferous veins; and we must guard against this in Mr. Wallace's case, particularly as there seem, on his own showing, to be exceptions to his laws, which can only be accounted for by assuming what we have already shown we are not justified in assuming. As will appear from those portions of the following extract which are printed in italics, the veins in certain lower beds are poor, although the facilities for the circulation of water are even "more favourable" than in those beds where the veins are rich. The assumptions (also printed in italics) by which this discrepancy is attempted to be met cannot be received without proof.

"From this inquiry into the conditions connected with lead ore deposits in veins traversing the lower beds, nothing has arisen to support the theory of sublimation of metallic particles from great depths, and their subsequent cumulation in patches by hydrous agency. *The conditions for promoting the percolation and circulation*

of fluids connected with some portion of the veins traversing the lower beds," (where they are poor) " *are in a few instances even more favourable than those connected with any of the veins in the upper beds*" (where they are rich). " *Yet how very different is the result in each case, notwithstanding the similarity of the circumstances and conditions. * * * * By the theory of lead, or of some lead ore producing substance, entering into the composition of rocks in varied proportions, variations in the amount of lead ore contained in veins under the same conditions are easily accounted for.* The decomposition of the limestone and sandstone rocks by fluids circulating in them near the surface may be effected to as great an extent in the lower as in the upper strata: *but in the latter case it may be that a less quantity of some unknown substance is set free to enter into those combinations necessary to form lead ore. * * * **

" From the enquiry respecting the lead ore deposits in the veins of Alston Moor, now brought to a close, it would appear that either lead in connexion with some *basifying principle* (sic) must enter, in varying proportions, as a component part of the rocks of this district, or *some still more elementary substances from which it is formed by laws of chemical combination as yet unknown.*

" I am not aware that the limestones and sandstones of Alston Moor have ever been subjected to careful chemical investigations. Should the most searching investigations fail to discover lead in the rocks, in this case I should feel inclined to adopt the other hypothesis, *that this metal is formed from still more elementary substances as yet unknown in a separate state*, but set free by the decomposition of the rocks, and held in solution by the circulating waters. As yet chemists have not been able to analyze pure metallic substances into simpler elements, but we are assured in the history of chemistry, and by the opinions of some of the best thinkers and experimentalists, that their supposed elementary character is " a mere passing idea." *Should this hypothesis be correct then the comparative non-productive character of the veins in the lower beds would be due to the small quantity of these substances entering into the composition* of both limestone and sandstone rocks."

That the great number of facts stated by Mr. Wallace form a most valuable addition to our knowledge of the conditions attending the lead veins of the North of England is not to be doubted; several of them are quite new, and they are all evidently stated with the most conscientious accuracy. Many of his conclusions also—for instance those with regard to the causes under which the veins originated, and their absolute geological ages—are equally valuable, and show that he has not in vain studied the great father of inductive philosophy. But in the principal theory which he seeks to establish—which is indeed the main drift of his book—we think there lurks a *petitio principii*, scarcely such as we should have expected from one who so familiarly quotes Mill's "Logic." Mr. Wallace conceives that the lead ore was deposited by water; and a careful examination shows that the conditions favour such a view. Many have before maintained this hypothesis, although none have hitherto worked it out so carefully; and so far Mr. Wallace is entitled to a greater amount of credit. But the primary difficulty—as to *whence* the metallic ores are derived—which previous enquirers have felt so great as to have considered progress hopeless until some clue is found to it, is still left unsolved; or we should rather say, is *de facto* assumed. Mr. Wallace takes for granted that, in some form or other, the lead existed in the rocks, whence it was taken and deposited in the veins by aqueous agency. In our opinion this is cutting the Gordian knot rather than untying it. In all theories of metalliferous veins, the first point is to decide the source of the exceptional abundance of metallic contents which characterize them; this is the major portion of the proposition, which it is not permissible for us to assume, without begging the whole question. No one considers it necessary to enter into lengthened disquisitions on the origin of calc-spar veins in limestone strata, or of quartz veins in rocks made up chiefly of silicated minerals; they are admittedly derived from the rocks which contain them, and with this admission all difficulty disappears.

Mr. Wallace objects to the hypothesis that the metals are derived from beneath, and in the case of the lead deposits of the mountain limestone his

objections seem to be well-founded. But attempting to prove an hypothesis by elimination—by showing that another hypothesis is still more improbable—is not science. Hundreds of enquirers into the phenomena of metalliferous deposits have wished to persuade themselves that they were justified in assuming the metallic contents of veins to be derived from their containing rocks; but, in the absence of any evidence, none have hitherto felt warranted in taking such an hypothesis for granted.

We have spoken candidly of this work, of its many merits and its weak points, for it forms no part of our intention to allow our notices of books to degenerate into mere indiscriminate laudations. It is much to be regretted that before publishing his speculations in the form of a book, Mr. Wallace did not bring them before some of the London scientific societies. In these assemblies—little parliaments of science—new hypotheses are certain to meet with a thorough sifting, and it is only after having gone through such an ordeal that even the most eminent men venture to put hazardous speculations into the more enduring form of a thick octavo. The theoretical weakness of some portions of Mr. Wallace's book militates, however, but very slightly against its general value. Taken altogether, with its magnificent maps and sections, it will long be referred to as a textbook of the Alston Moor district, and as a reliable repertory of facts connected with the conditions of the formation of lead ore in limestone districts.

Bristow's Glossary of Mineralogy.

A Glossary of Mineralogy. By Henry William Bristow, F.G.S., of the Geological Survey of Great Britain. London: Longmans.

Mineralogy has not, in modern years, been very popular in England. This has been attributed by many to the excessive pedantry and technicalities in which writers on the science have loved to indulge—and which some years ago was the subject of a sharp rebuke from Professor Sedgwick. Indeed, of all those branches of natural science which mainly depend upon a classification of species, there can be little doubt that, for a considerable time, mineralogy has been investigated on a comparatively narrow and pedantic system; a system which delighted in multiplying species as much as possible by dwelling upon, and often exaggerating, the minutest differences. That a science pursued in this spirit—particularly when coupled with notions of the unchangeableness of species borrowed from the dogmas of biological science—should have been repulsive to men of larger views, caring little for a pursuit whose whole end and aim seemed to be the measuring of angles, is not surprising. Recently, however, mineralogy, like other branches of natural science, has been pursued in a wider spirit, and abler enquirers have taught us that its main object should be to bring allied species together—to trace their similitudes and transitions—rather than to isolate them by barriers, often imaginary. Under this new principle of prosecuting mineralogical researches, the science, hitherto so barren and repulsive, has, to adopt the idea of the greatest mineralogical writer in the English tongue, become a living thing. The mineral kingdom, instead of being put before us as consisting of so many hundred disconnected species, each isolated from the other by impassable barriers, is now presented as a whole—as a regular series of mutable species passing insensibly into each other from one pole of the mineral kingdom to the other. Pursued in this spirit, mineralogy becomes one of the most interesting—indeed we may say fascinating—branches of natural philosophy, and one of the very highest importance in elucidating many of the greatest geological problems yet unsolved.

In making these observations we have, of course, no intention of speaking disparagingly of an accurate knowledge of crystallography, which must be the basis of all sound mineralogical knowledge. We only object to mistaking the *means* for the *end*, as seems to have been done by a class of enquirers whom we might best describe as "cabinet" mineralogists, whose object has been to isolate species and regard them without reference to each other; while the object of the geological and chemical mineralogist should be to regard them in their relations and associations—or their *paragenesis*, to use the word employed by the Germans.

Besides the great work of Dana, there are two other highly popular English mineralogical works—Philips's Mineralogy, edited by Brooke and Miller; and Nicoll's Manual of Mineralogy. The former is a work of great authority, Professor Miller being undoubtedly the most eminent English mineralogist; but neither the systems of classification nor crystallography have met with as much favour as those adopted by Professor Nicoll, whose manual is now out of print, and which must not be confounded with a more recent work of his on the same subject—a reprint, we believe, from the last edition of the *Encyclopædia Britannica*. But there has been hitherto no work in English at all answering to this "Glossary" of Mr. Bristow. It is a Dictionary of Mineralogy of the most complete kind, and yet in the most portable form, and must become a *sine quâ non* to every practical mineralogist. Unincumbered with any system of classification, it describes every mineral species or variety alphabetically, with cross references to synonymes, English, French and German.

The description of the minerals is at once concise, and yet sufficient for practical purposes. It includes their crystalline and physical characteristics, chemical composition (shown both by formula and analyses), behaviour before the blowpipe, and their principal localities and uses. It need scarcely be said that Mr. Bristow having the resources of the Jermyn Street Museum at his hand, as well as the assistance of so eminent a mineralogist as Mr. Warington Smyth, has had great opportunities of turning out a good book. And he has certainly done so. We can only find one fault, which is the formula he adopts for silicic acid, $Si\ O^3$. We think that this is a mistake, particularly so in a work on mineralogy, as recent enquiries give us reason to suppose that this acid is isomorphous with other compounds of the form $R\ O^2$. The benefit of keeping to the old formula is very slight, particularly now that it is renounced by Rammelsberg, who has adopted the formula $Si\ O^2$ in his new *Handbuch der Mineralchemie*.

Notwithstanding the great body of information it contains, this little volume has the advantages of extreme clearness of type and great portability. For tourists and practical men interested in mineralogy it will be indispensable; among the former we expect Mr. Bristow's green book will be seen often side by side with Mr. Murray's red volumes.

The Government School of Mines, and the Museum of Practical Geology.

THE Students' Lectures at the School of Mines will be resumed on the 6th of January; when Dr. Hofmann will commence a course of thirty lectures on "Organic Chemistry."

Mr. Warington Smyth will also continue his course of lectures on "Mining." In that portion of his course already delivered Mr. Smyth has discussed the conditions connected with the deposition of the useful minerals, and the laws regulating their occurrence, as far as our knowledge goes; examined their accidents, dislocations, and the points to be observed

in searching after them; and described the modes of boring for and excavating them, and the tools employed. In the lectures yet to be delivered, Mr. Smyth will discuss the modes of sinking shafts, driving levels, &c., and the various methods of securing them: describe the usual methods of working away mineral deposits, transporting the produce underground, and drawing it to the surface; as well as the most approved arrangements of draining and ventilating mines.

Mr. Smyth will also continue his course on "Mineralogy," which however is drawing to a close.

Dr. Percy will likewise resume his course of lectures on "Metallurgy." In continuation of those already delivered, he will proceed with a special description of the processes connected with the treatment of argentiferous copper, silver and gold ores, with the alloys of these metals, and the modes of assaying them. Following these, the Doctor will treat of the metallurgy of mercury, antimony and its alloys, bismuth, nickel, cobalt—including the manufacture of cobalt colours. Next of arsenic and arsenious acid, and the smelting of the ores of tin. The last section will be on the making and manufacture of iron and steel.

Professor Huxley's course of "Natural History," now about half completed, will also be continued.

Early in February two other courses will be commenced—one of thirty lectures, on "Geology," by Professor Ramsay; and another of about thirty-six lectures, by Professor Willis' on "Applied Mechanics."

In addition to these students' lectures, two courses of evening lectures, for working men, will be delivered during the month: one by Dr. Hofmann on the "First Principles of Chemistry;" and another by Mr. Geikie, who temporarily supplies the place of Professor Ramsay, on "Geology." These lectures are of great value as a means of disseminating sound scientific knowledge among the body of the people, by whom the opportunity is fully appreciated. Mr. Geikie's course, which will comprise a condensed description of the geological formations of the British Isles, we strongly recommend to the attention of our readers, residing or sojourning in London, who come within the definition of "working men."

The Geological Survey of the United Kingdom.

Of all the labours of the survey, none are more important than those pursued of late in the Midland, Lancashire and Scotch coal fields, which have resulted in memoirs on the Warwickshire, Lancashire, and Edinburghshire districts, recently issued, the importance of which, in an economic point of view, it is really difficult to estimate too highly, particularly those laid down on the 6-inch scale. In addition to the eight 6-inch maps already published, a new vertical section is now ready, on a scale of 40 feet to an inch, illustrating the position, mineral character, and thickness of each bed of the Permian and Carboniferous strata, as they are met with in South and West Lancashire districts. The system recently adopted of issuing a descriptive memoir with each new map, in which various information of great value is given, and the geologist is pointed out where the best fossil localities, the best exposed sections, &c., may be found, much enhances the value of the maps.

Among the other new publications of the survey are the following:—A Memoir on the Geology of the Isle of Wight, by Mr. Bristow, containing a list of fossils, by Mr. Etheridge; and Notes on the Eocene Flora of Alum Bay by P. de la Harpe and Mr. Salter. This memoir describes all the formations in the island, in addition to those already treated on in the late Professor Forbes' memoir, which was confined to the Tertiary Fluvio-

marine deposits. The list of fossils is most complete, and numerous illustrations are given of the characteristic forms of such stratum.

A memoir descriptive of map 12 (parts of Berkshire and Hampshire) by Mr. Bristow and Mr. Whitaker, containing a list of fossils by Mr. Etheridge, is also ready. Likewise, a new decade (No. 10) giving a description of the Fishes of the Devonian Epoch, by Sir P. de Malpas Grey Egerton, with a preliminary essay on their systematic arrangement by Professor Huxley, in which the whole question of the classification of the Devonian Fishes is considered, "and results arrived at which seem to necessitate an important modification of the received arrangement of the great order of *Ganoidei*."

The "Iron Ores of Great Britain," part 3, contains a general description of the iron ores of South Wales, classified as follows:—

1. Clay iron-stones found in coal measures.
2. Iron ores of the carboniferous limestone.
3. Iron ores of the Permian series.

This we shall refer to more fully on another occasion.

Mining, Quarrying, and Metallurgical Intelligence.

CORNWALL AND DEVON.

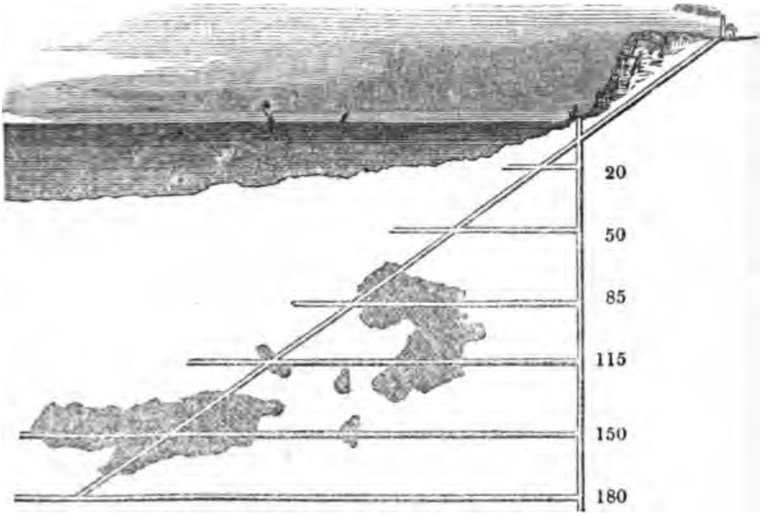
St. Just District.—Notwithstanding the just celebrity and great productiveness of this, probably the most ancient mining district in the world, it is a matter of fact that there are only two mines in it at present paying dividends—and those not large ones. This, at first sight, may appear a very unpromising state of things, and might induce many to believe that the district had retrograded from its ancient fame; but a closer examination shows this not to be the case, for we find that the old-established and hitherto well-paying mines have suspended dividends, not from dire necessity caused by exhaustion and poverty, but from the desirability of making large expenditure on new works required by the altered modes of modern mining. Thus, in every direction we see new works going on: new shafts sinking; new pit-work being put in; new stamping and winding engines being erected; all which, although dead work at present, will produce their harvest in good time. The mines paying dividends now are:

Wheal Owles, one of the few mines remaining of the thorough old Cornish stamp, divided only into 80 shares, not one of which has changed hands for years. This mine was long under the management of the late Mr. John Boyns, better known in St. Just as "Purser Boyns;" a most worthy and excellent man, and a fine specimen of the legitimate Cornish miner of that "olden time"—now almost a thing of the past—when Cornish men worked their own mines, and consequently worked them fairly and honestly. He has a worthy successor in his nephew, the present purser, Mr. Richard Boyns. Wheal Owles is not a rich mine, but it is well worked and cautiously managed. The produce is principally tin, which is of very fine quality. At the last account the dividend was £400. *Boscean* divided £240 at the last account. The floors at this mine are now very compact, a new water-wheel, and twelve heads of stamps, having been recently erected, as well as a new tramway laid down.

Among the mines not paying dividends, the most important is *Botallack*. Few of our readers can be unacquainted with this fine old mine—one of the great sights of Cornwall—worked out under the sea for nearly the third of a mile: every one who has "done" West Cornwall, or even read about it, must remember Botallack, with its high precipices, and its engine-houses and machinery perched upon ledges of rock and washed by the storms of the Atlantic.

· This mine is worked under the sea at two points—at Wheal Cock and at Crowns. The accompanying sketch, fig. 1, is a rough section of the latter

FIG. 1.



SCALE 50 fathoms to one inch.

mine, showing the position of the workings under the sea on the Crowns lode, and the new diagonal shaft which, after a labour of four years, is now nearly completed.

Those who have visited Botallack may remember standing on the cliff at this part of the mine, and looking down, a distance of 250 feet, upon an engine perched upon a ledge of rock employed in winding from a shaft some little distance below that again. The shaft is called Pearce's whim shaft, and is the one shown in the section: to get to it you had to descend a winding path cut in the cliff, called the "Mules' path," from having been originally made for the use of mules, to carry up the ore from the shaft to the dressing-floors above. This whim shaft has been sunk to a depth of 180 fathoms; but at every succeeding level, longer and longer drivings had to be extended from the shaft seaward, through unproductive ground, in order to reach the orey part of the lode, which dips away from the land, as will be seen by the section, where the orey parts are shown in shading. Thus at the 150-fathom level, upwards of 200 fathoms of dead ground had to be gone through; and at the 180-fathom level, 260 fathoms of dead ground. To pursue the shoot of ore further, under such circumstances, became impossible. In a mine working under ordinary circumstances the difficulty could have been met by sinking a new shaft down upon the orey ground; but as it was not possible to sink a shaft in the Atlantic Ocean, this resource was closed to Botallack. The lode was not to be readily abandoned, for it was a very rich one, having in one year, between the 85 and 115, yielded £24,000; and the ground above the 150 having yielded £50,000. At last it was determined to sink a new diagonal shaft from the surface, at such an angle that it should cut the productive part of the lode in the bottom levels. As shown in the section this has now been accomplished, the shaft having been sunk 345 fathoms, cutting the 180-fathom level at a distance of 260 fathoms from Pearce's shaft. As the Crowns lode is enclosed in hard greenstone rock, it was found impracticable—except at an enormous cost—

to make the shaft larger than 6 feet square. This is, of course, a very small size for a shaft, and precludes the possibility of having more than a single wagon-way: the wagon used will hold about 16 cwt.

Winding from Pearce's shaft is now discontinued; and as the boilers from thence are to be used for the engine erected at the head of the new diagonal shaft on the top of the cliff, the operation of moving them took place a few weeks ago. This was a matter of no small difficulty, as they had to be drawn up over a cliff of about 40 fathoms in perpendicular height: one of the boilers (of 9 tons) was lowered there twenty years ago, and the other (of 10 tons) was built in its place. To raise these, an inclined roadway of balks of timber was laid down (supported by cross-pieces and uprights from the face of the cliff) 70 fathoms in length. At the top of this two hand capstans and two winches were fixed. Chains were firmly secured at top, carried down the incline, passed round the boiler to be raised, and then fixed to the capstans.

By these means the boilers were fairly *rolled up* in the most successful manner, without any mishap whatever. The work of fixing them in their new position is being actively proceeded with, and in the course of a short time winding will be commenced at the new shaft.

Besides the sinking of this new diagonal shaft on the Crown's lode, which is the copper portion of the mine, great improvements have also been made in the tin dressing departments. A steam-stamps of 32 heads has been erected, and very excellent floors have been laid out with all modern improvements—including several of the German rotating frames. But little debt now remains on the mine; and as its position will in every respect be improved, and its returns increased, we may expect to see it shortly again resume dividends. The energy and economy with which the new works have been carried out at this mine reflect great credit on the management of the purser, Mr. Stephen Harvey James, of St. Just.

Levant, another mine worked under the sea, and which was formerly very productive and profitable, has lately, like Botallack, been spending large sums on new machinery necessary to keep pace with the times. This was one of the first mines in the district to adopt modern appliances, and its example in this respect has been very useful: several rotating frames have also been erected here.

Balleswidden, a great old mine, has also for a long time been laying out money. A new 80-inch engine is now being erected, and new pit-work put in. When this is completed the mine will be in a position to be worked vigorously, by sinking deeper and opening out new ground.

At *Boscaswell* the work now carried on consists in clearing old levels and driving up a deep sea adit. In former workings this mine made large returns, and the present party have made considerable sales from the waste heaps of their predecessors, which has helped them considerably in erecting their new machinery.

Bosorn and Bollowall United—two old mines united and worked as one. As yet no machinery has been erected, and the operations are confined to clearing up old levels. The sett contains numerous lodes, from some of which good stones of ore have been broken in the bottoms.

Bosweddan and Wheal Castle is very peculiarly situated in a narrow valley, where the sides rise so steep on either side that there is scarcely any level ground on which to build; so that, for buildings and floors, the ground had to be cut away and "made" at great expense. Good machinery is now erected; and a new incline shaft completed to explore the portion of their lodes running under the sea. At the last account, a call of £800 was made.

At *Carnyorth* and *Spearne Consols*, which were formerly worked together but are now separated, the operations are confined to explorations. *Spearne Moor* is looking better.

Pendeen Consols, in the northern part of St. Just, is a mine which has justly attracted a great deal of attention. It has been opened out in a vigorous and workman-like manner; but the operations seaward have been for some time suspended, pending arrangements between the lords of the soil, the duchy and the crown, as to their respective rights to the minerals found under the sea. These being now settled, we may expect to see the levels resumed diving seaward, where there is every prospect of good results.

MARAZION DISTRICT.—The only mines in this district at present presenting any features worthy of special notice are *Wheal Grylls* and *Prosper United*. In the former a valuable bunch of tin—of the nature of a "carbona"—has been discovered above an old adit level, from which considerable returns have been made. A stamping engine is now being erected, which may be expected to be at work early in the year, and from which a flat rod will be connected to follow down this rich shoot of tin. If it should continue for any depth as it has been above adit, fine returns may be expected in a short period. The value to tin sold in the stone last month was £722.

Prosper United was brought before the public about eighteen months ago, and found such favour with them that the shares went to £1 per share premium, or £6,000. That the mine is an excellent speculation is undoubted, but that it was worth paying at the rate of £6,000 for the privilege of partaking in it is not by any means so clear. Taken in connection with the reaction which followed, it is a remarkable instance—and one worthy of noting—of the unreasoning and impulsive spirit with which a certain class of mine speculators seem to be animated, which induces them to run after things at prices evidently far above their real value, and then (like a child with a toy) rush panic stricken to realize at a price equally below their value. A heavy concern like Prosper United, requiring immediately five steam engines—including two 70's—was, on the face of it, a speculation requiring large expenditure, and which could not possibly be brought into working order under a couple or three years. Yet the very same speculators, who a few months before had given £6,000 for the privilege of taking part in the enterprise, rushed to sell, and knocked down the shares to a nominal price. Nothing, of course, had occurred in the mine to justify this, because the engines were not half up: the circumstances were precisely the same when the public eagerly scrambled to give £6,000 for a concern upon which not a single shilling had been spent, and rushed (equally eagerly) to sell the same at the rate of £2,000 or £3,000 when £12,000 or £15,000 had been spent upon it, and when it had really gone some way towards becoming a property. And yet people who act like this are surprised that they lose money by mining!

Since this panic a discovery has been made in one of the shallow levels which has restored the shares to something like their intrinsic value. This is very fortunate, for no one can tell what might have happened under the effect of a long continuance of the panic-spirit: the necessary capital to complete the opening of the mine might not have been forthcoming, and the whole concern might have ended in a wanton waste of £15,000 or £20,000. Happily this danger is now a thing of the past, and we may expect to see the mine become, under the able management of Captain Thomas Richards, largely productive, and, it is to be hoped, profitable to the adventurers.

REDRUTH DISTRICT.—This district, which for a lengthened period has not been the scene of many new improvements, and which indeed has been now for some time living on its old discoveries, has been looking up lately. *East Carn Brea, South Carn Brea* and *North Downs* have deservedly attracted a great deal of attention within the last few months, and the former now shows every indication of becoming a great mine. It lies close to the town of Redruth—a little to the south-west—and is worked on a run

of lodes which may be considered a continuation of those wrought in the eastern part of Carn Brea Sett: it lies in nearly the same parallel as Wheal Buller and the Tolguses. On the opposite page we give three sections of the mine, which will help to make a description more intelligible. Fig. 2, a transverse section, shows the engine-shaft sunk on a lode called the "Engine lode," and now down nearly another lift below the 50—with levels at the 26, 40 and 50. Besides this engine lode, three other lodes are shown, one to the north, and two to the south.

Of these lodes, the main one—indeed the only one of much importance—is the southernmost, marked "South lode" in fig. 2. This lode has been intersected by cross-cuts from the engine-shaft at the depths of 26, 40 and 50 fathoms, at which depths levels have been extended east and west, as shown in fig. 3, which is a longitudinal section on this lode. In the 26 east from the engine-shaft the end has lately passed through a large cross-course, 5 or 6 feet wide, crossing the lode at an angle of about 45°. Just at the point of intersection this cross-course naturally disturbed and impoverished the lode; but about 6 fathoms west of it, a fine course of ore worth £60 per fathom for a short distance was passed through, and east of this, close up to the cross-course, the lode was worth from £15 to £20 per fathom. East of the cross-course the lode has again recovered all its former productiveness, the end being now reported worth £60 per fathom. It is important to observe that another cross-course is reported to exist about 40 fathoms again east of that shown in the section; and those who favour the mine anticipate—and not unjustly—that a course of ore may be found to extend from cross-course to cross-course.

The discoveries made in the lower levels on this south lode are equally satisfactory. Valuable ore ground has been opened out at the 40 and 50, which is shown in the section by *dotted* spaces, the shaded part showing the ground that has been taken away. Since the figure has been cut a good lode of ore has been met with in the 50, that level west being now reported at £25 per fathom, and the 50 east at £20. The 40 has also passed through a fine run of orey ground, and that level east being now valued at £45 per fathom.

The engine lode has hitherto been small and poor. The middle lode, of which a section is given in Fig. 4, has made a run of orey ground about the engine shaft, never rich, but just productive enough to come away on tribute, being worth from £6 to £10 per fathom. Besides these three lodes, others are known to exist to the north; one of which, shown in Fig. 2, may be expected to be cut very shortly. If this should turn out productive, it is needless to say how important it would be to the mine.

As no ore has been taken away below the 26, large reserves have been already accumulated, which so far from being trenched upon by the present returns of 250 or 300 tons per two months, are unquestionably at present accumulating, so that the returns may shortly be increased and fine profits realised.

East Carn Brea was started about 4 years ago by Mr. Joseph Lyle, of Bonithon, and about £20,000 has been spent in bringing the mine to its present desirable position. Mr. Lyle also started the present working of Carn Brea Mines, and was the means of bringing West Basset, North Basset, and Great South Tolgus to a successful issue. Every success gained by such a veteran miner, and one who has persevered so determinedly through good and evil fortune, should be a matter of general congratulation. The Messrs. Thomas, of Threadneedle Street, well known for their connection with Devon Consols, have the good fortune to be large shareholders—having, for some years, been connected with Mr. Lyle in his mining enterprises in the neighbourhood of Redruth.

North Downs, as will be seen by our abstracts of accounts, has divided another 5*s*. per share, adding £162 to the reserve fund. Great hopes are now entertained that the rich course of ore driven over in the 50 east may

East Carn Brea Mine.

Scale 50 fathoms to an inch.

Fig. 3.
Longitudinal Section on South Lode.

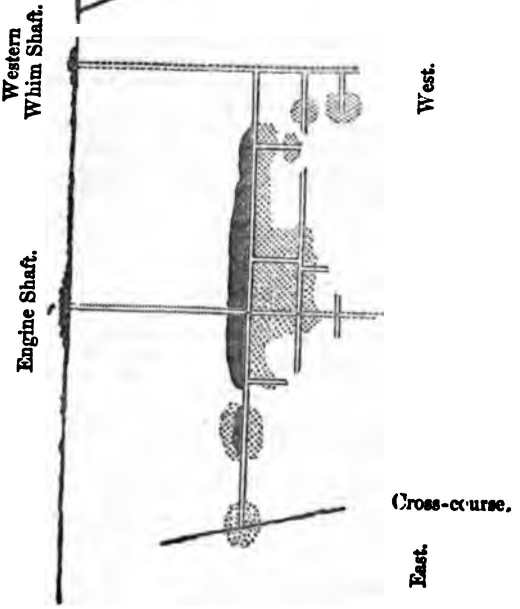


Fig. 2.
Transverse Section.

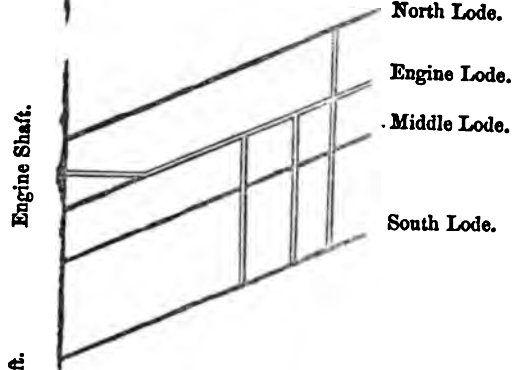
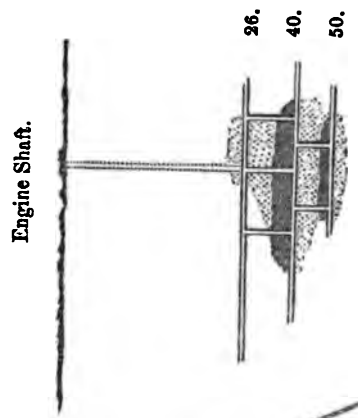


Fig. 4.
Section on Middle Lode.



be soon intersected in the 60, that end having, during the recent driving, let down all the water from both the 50 ends. Of course this point is of immense importance.

GWENNAP DISTRICT.—The amalgamation of the United Mines and Wheal Clifford into one sett will, it is to be hoped, give such stability to the concern as to ensure its profitable working for many years. Among progressive things in this neighbourhood may be mentioned *Nanjiles, Wheal Moyle, Wheal Damsel* and *East Damsel*. The former mine is now in such hands that we may fairly expect to see it worked, at last, in a really vigorous manner. Wheal Moyle is turning out quite as successfully as could be expected for the time it has been at work, and its success is said to be likely to cause the reworking of Ting-Tang. Indeed this would probably have been already effected but for the dull state of trade and consequently of speculation. At the eastern part of Wheal Damsel, and at East Damsel, cross-cuts are now being driven to intersect the south lodes, which are drained to a considerable depth by the workings of their great neighbour, Clifford Amalgamated.

WENDRON DISTRICT.—This old tin district has been the scene of greater activity within the last year or so than it has ever been before. Numerous concerns have been put to work, but unfortunately many have proved unsuccessful, principally owing to being put into the hands of agents unaccustomed to the peculiarities of the district. The difference between management of this sort and really good local management is best shown in the case of *Basset and Grylls*, which hitherto has been a good mine spoiled by bad management; but which is now about to reward those who have had the courage to take to it after its great disaster. There are other concerns in the same neighbourhood, which, were they under the same or similar respectable management, might be expected to give equally good results.

The following is the last report on *Wendron Consols* of Captain John Taylor, by which it will be seen that that mine is progressing favourably in opening out its eastern ground called Bal Dees :—

The engine shaft men are driving west on engine lode at the 45-fathom level at £22 per fathom; lode 4 feet wide, worth £20 per fathom.

Bishop's shaft is being sunk below the 52-fathom level on engine lode by six men, at £35 per fathom; lode 3 feet wide, worth for length of the shaft (10 feet) £20 per fathom, and is likely to improve.

The 52 east of this shaft is driving by four men at £22 per fathom; lode 3 feet wide, worth £14 per fathom. The 52 west of same shaft is suspended for the present, while the men are engaged rising close behind the end for ventilation and to lay open the ground; lode in the rise 2 feet wide, worth £5 per fathom, and rising at £7.

The 42-fathom level is driving east of Bishop's shaft on engine lode by four men, at £13 per fathom; lode 2 feet wide, worth £14 per fathom.

The 32-fathom level is being driven east of Hurler's shaft on engine lode, at £14 per fathom; lode 2 feet wide, worth £10 per fathom. The tribute pitches in this part of the mine are improved.

Six men are driving the 80-fathom level west of Hill's shaft on Flander's lode, at £12. 10*s*. per fathom; lode 2 feet wide, worth £7. 10*s*. per fathom. The 40-fathom level is being driven west of same shaft on Flander's lode, at £10 per fathom; lode 3 feet wide, unproductive. Here our object is to get under the tin ground seen in the 20-fathom level, about 16 fathoms further west.

The 30-fathom level is being driven west on north lode by four men, at 12*s*. 6*d*. in 20*s*.

The 20-fathom level is being driven west on same lode by two men, at £2. 10*s*. per fathom, opening tribute ground.

Bal Dees diagonal shaft is being sunk below the 35-fathom level by six men, at £15. 10*s*. per fathom; lode 2 feet wide, worth £12 per fathom, and is improving.

Bal Dees perpendicular or new engine shaft is sunk 2 fathoms below the 35, and a tip plat cut, bearers and cistern fixed, and we shall without delay begin to fix our

pitwork at that level. The new boiler is in its place, and the engineers are getting on as fast as possible in heaving in the engine, which we hope to get to work by the end of the year. When this is done, we shall be able to develope this part of the mine to a greater extent than we have hitherto been able to do; and, judging from the discoveries already made, we think this will soon be an important part."

New Tin-Smelting Company.—For many months past there has been considerable talk in West Cornwall—particularly at Redruth—about establishing a new tin-smelting company. The persons whose names were mentioned in the matter are of some influence in mining, and consequently would probably be able to procure a supply of tin under the present system —although some suggestions have also been made about again attempting to introduce a system of ticketing for tin ores. As most of our readers are aware, all the black tin raised in Cornwall—excepting two or three eastern mines—is now carried to some particular smelting-house, and there sold by private contract according to the "standards" of the day—the money value being calculated in the manner shown in page 25. The standard and allowances being the same all through the trade, there is no advantage (theoretically at least) in going to one house more than another; consequently, in choosing those to whom to sell their black tin, miners are influenced generally by collateral considerations. Hence, a new company without powerful mining influence would have no chance of getting any tin, for there is no open market into which they could go and outbid the present customary purchasers. The system of tin ticketings was tried some years ago, but failed.

LISKEARD DISTRICT.—Of this district, at present the most rising in Cornwall, we shall not say anything at present, as we purpose, in an early number, giving a detailed description of it.

WALES AND THE BORDERS.

CARDIGANSHIRE.—This district has been at once one of the most fortunate and one of the most unfortunate in the kingdom. Those mines which have had the good fortune to be under the management of Messrs. Taylors have had more than an average amount of success; while, strange to say, all started under other management have been complete failures—and these latter have not been few, or trifling in the money expended. Within the last twenty years scores of such concerns have been started, and immense sums of money lost, without one solitary success. This is too remarkable a result to be due to mere chance; and consequently our readers will not be surprised when we state that the contrast between Messrs. Taylors' success and the unvarying failure of others, is due to causes easily traceable and well understood by those acquainted with the history of mining in this district. It would be out of place to enter into these matters here; but we cannot refrain from suggesting to those who may be about speculating in Cardigan mines the advisability of making a few inquiries into the history of transactions in that district during the last fifteen or twenty years. That Cardiganshire is a great mining district is undoubted; but that from unhappy causes—and above all, from one unhappy cause—it has entailed a miserable amount of ruin on many unhappy speculators, is unfortunately still more clear.

Among those mines in this district which, from the respectability of their management, may be classed in the same category as Messrs. Taylors' mines, we may mention the concern now started as *Cardigan Consols*, of which Messrs. Phillips and Darlington are consulting engineers. With sufficient capital and proper management, these mines have every prospect of doing as well as the best in the district.

A step, which threatens to have a very serious effect on colliery property in the Flintshire and Denbighshire coal fields, has been recently taken by

the Mersey Dock and Harbour Board, who have imposed an additional tax of 3*d*. per ton on all coal shipped at Birkenhead, making, with the dock and town dues already levied, 6¼*d*. per ton, or 5 per cent. on the value of the article as put on board ship, and nearly 10 per cent. on its value at the pit mouth. Birkenhead is the chief port for the shipment of the coal of North Wales; and as the article, though of inferior quality for domestic purposes, is well suited for exportation, a considerable trade has sprung up during the last dozen years. The Birkenhead docks were opened in 1846, and since that time the production of coal in North Wales has greatly augmented, a very large proportion of it finding its way to Birkenhead to be shipped there. From 1846 to 1857 the charges on coal exported, including use of rails, &c., was 2*d*. per ton; but when the Birkenhead docks came into the hands of the Mersey Board, the sum was raised to 3¼*d*. per ton, although no additional facilities were afforded for the extra dues levied: at present the facilities for shipment being far from being as extensive as they were before the opening of the Great Float. The former owners of the docks deemed 2*d*. per ton an adequate remuneration for the facilities afforded, and certainly no change has since been effected which would warrant the present owners in trebling the charge.

A memorial has been recently presented to the Board, by a number of gentlemen interested in the trade, and signed by the principal coal owners on the district, including the Brymbo and Broughton Companies, represented by Messrs. Darby; Messrs. Maurice and Low, of the Vron Colliery; the Bryn Mally and Westminster Brymbo Companies, and numerous others. The memorialists express their "surprise and regret" at the additional imposition, and compare it with the charges made at other ports:—At Garston, 2*d*. per ton; at Hartlepool, 1½*d*.; at Newcastle, ¾*d*.; at Cardiff, 2*d*.; at Swansea, 1½*d*.; and at Newport, 2*d*.; for which sums far greater and more extended accommodation is provided than at Birkenhead. They also append a list of articles, the dues on which vary from 1*d*. to 8*d*. per ton, but the value per ton of which greatly exceeds that of coal; and point out that if value is any criterion as to the extent of dues that ought to be levied, those on coal should be reduced instead of increased.

The following remarks of the "Colliery Guardian" on this extraordinary measure no doubt fairly represent the views of the colliery trade, not merely on this special case of exaction, but generally as to the arbitrary proceedings of railway boards and other bodies, in altering their rates to such an extent as to jeopardise large branches of industry.

"The motives which have actuated the Mersey Board in framing this scheme of extortion are altogether beyond ordinary comprehension. Before the Board was established, it was urged by many that, if the docks on both sides of the Mersey were placed under its jurisdiction, the trade of Birkenhead would be sacrificed to that of Liverpool whenever the two came into competition, and it may be insinuated that what is now really aimed at is the transference of the Birkenhead coal trade to the other side of the river. This supposition, however, is absurd, for in the first place the Mersey Dock and Harbour Board show no wish to encourage the Liverpool export coal trade, and in the next place, if the coal trade were driven altogether away from Birkenhead, very little more coal would be shipped from Liverpool, for neither the Wigan coal nor the St. Helen's coal could compete with that from North Wales in cheapness, and indeed in other points wherein it is peculiarly suitable for certain markets. Perhaps the Board aims merely at the increase of its revenues by thus roughly augmenting the charge on one of the principal articles of export. They are much more likely, however, to drive the trade somewhere else, or extinguish it altogether. The coal shipped at Birkenhead is not worth more than 5*s*. per ton at the pit's mouth, and on this price 6*d*. per ton is a very handsome profit; and, indeed we have a notion that the increased charge would itself absorb the profit in most cases. The price cannot be mate-

rially enhanced owing to the active strenuous competition at Newcastle and Cardiff, and thus, if the Board persist in its resolution to impose this additional charge, they will not only severely punish, and indeed grievously oppress the colliery owners who use the port of Birkenhead, but will completely stop the further development of the export coal trade there.

"On looking at the list of firms subjoined to the memorial, one cannot help feeling some astonishment that a body of gentlemen possessing a very large amount of capital invested in an important branch of industry, and employing a great number of workmen, should find their property placed at the mercy of an irresponsible board, who neither know nor care anything about their interests. A week or two ago we drew attention to a resolution of the London and North-Western Board, imposing an additional charge of 6d. per ton on all coal introduced by their line into the metropolis. A deputation of gentlemen waited upon the directors to prevail upon them, if possible, to rescind the resolution, but argument and remonstrance were ineffectual, and the increased charge is to be exacted. Surely these things, coming one after another, will awaken colliery owners throughout the country to a sense of the danger to which they are exposed from the arbitrary exactions of railway boards, and other bodies having control of the channels of traffic. A time will come when these impositions will be intolerable, and a remedy must be sought from the legislature by means of combined action. As respects the Birkenhead case, great credit is due to Mr. W. Laird for his energy and spirit in taking the matter up, and we trust that his efforts in abating the grievance will be decidedly successful."

Since the above was written, it has been decided at a meeting of the Mersey Dock Board—To fix a charge for the use of the coal tips at Birkenhead at 2*d*. per ton. The use of the low level to be free. A charge of one-halfpenny per ton to be made for weighing at either place.

South Wales Institute of Engineers.—The quarterly meeting of the members was held in the Assembly Room of the Castle Hotel, Merthyr Tydvil, on Thursday, the 12th Dec. The chair was occupied by the president for the year, Wm. Adams, Esq., of Ebbw Vale; and the vice-chair by W. S. Clarke, Esq., of Dowlais. There was a large attendance, including Thomas Evans, Esq., Government Inspector of Coal Mines for South Wales.

Owing to the inability of Mr. R. Schmidt to attend the meeting, the discussion on his paper upon "Professor Jenner's diagram for showing the motion of the slide valve," was postponed. It is likely to produce a considerable and animated discussion when taken into consideration, for it was intimated that another paper on the same subject, by Mr. W. C. Pearce, of Cyfartha, will be read at the next meeting. The Secretary then read a paper on "The Sanitary Condition of Mines," by Mr. Mark Fryar, of Glasgow. The writer expatiated upon the advantages of proper ventilation, considering the large number of men daily and nightly employed in the coal mines of Great Britain and Ireland. Everybody knew that the noxious gases were caused by the decomposition of the matter or stratifications which composed the coal, and these gases were emitted by the cutting. The paper then treated of the several means at present adopted for clearing off the noxious gases, and entered upon scientific data to prove what amount of pure air was necessary to dilute and render harmless the various noxious gases. Referring to the accidents caused by explosions, Mr. Fryar observed that, notwithstanding the loss of life by sea was large, it had been ascertained that the loss of life in mines was considerably greater. The sanitary condition of pits in the North of England was, generally speaking, much better than in Wales; and he hoped that colliery proprietors would adopt the means—scientific means—in their knowledge and power to ventilate the pits under their control. The paper was ordered to be printed in the Transactions of the Institute, and will be discussed at the next meeting, and a vote of thanks was awarded to Mr. Fryar. Mr.

A. Murray's paper upon the "Pembrokeshire Coal Fields" was not received in time, and its reading was therefore postponed until the next quarterly meeting. Papers were then read by Mr. G. Ashcroft, on "A Plan to improve Canal Locks, and to render canal carriage less costly," and by Mr. T. D. Steel, on "Giffard's Injector." The papers were not discussed, being ordered to stand over until the next meeting, to allow of their publication in the Transactions.

Rating of Collieries and Mines.—The following communication on this subject appears in the *Mining Journal*, and communications to a similar effect have appeared in the *Colliery Guardian*:—Complaints are continually being made of the manner in which collieries are assessed for poor and highway rates. From the information collected by Mr. Kendall, when he had his bill for taxing metallic mines before the House of Commons, the opinion seems universal that improvements in the law of rating both collieries and metallic mines are absolutely called for. Whether the impartial discussion of the subject will result in the taxation of all mines, or in their exemption, it is almost impossible to predict, but the opinion is certainly in favour of the former course—the taxation being upon an equitable and easily-understood principle, From the remarks of the various authorities who have handled the subject, it seems that the greater proportion consider that, if all mines were rated upon half of the amount paid over to the lessor or lord, no one would object, and there would be general satisfaction.

It is rumoured that, in the ensuing session, the subject of the rating of mines will be revived in all its force, and, if Mr. Kendall and his supporters include both coal and metallic mines under one Act, the point may be readily settled, and lasting benefit will be conferred upon all. The sole basis for the rate should be the royalty paid by the person working the mine or colliery, and the onus of proving that the tax is leved on too high an amount should be thrown upon the party by whom the tax is to be paid.

MIDLAND COUNTIES.

South Staffordshire.—The *Mining Journal* correspondent reports:—The preliminary meeting of the Ironmasters' Association was held at Dudley this afternoon. It excited comparatively little interest, as no change in prices was expected. Trade is very quiet, but a reduction in the price of finished iron below £7 for bars, the present price, would not readily be submitted to; and the political aspect, in respect to peace or war with America, is so uncertain that a change would not be thought of under present circumstances, even if existing rates offered more margin for reduction. The sale of pig-iron for the next quarter has not commenced, and sellers' prices remain at £3. 7*s*. 6*d*. to £3. 5*s*. for very best makes of hot-blast native pigs, £3. 2*s*. 6*d*. to £3 for a good quality of all mine pigs, declining to as low as £2. 5*s*. for very inferior flue cinder pigs. Hematites are offered at £3. 5*s*., and although £3. 9*s*. is talked of, the Barrow Company, whose quality is unexceptionable and unquestioned, are open to sell at the former rates. North Staffordshire makers are asking more money, and £2. 15*s*. to £2. 17*s*. 6*d*. is quoted for best makes.

Referring to the present entire absence of trade, the *Colliery Guardian* correspondent remarks:—It is true, that in some cases orders might have been booked if makers would accept rates utterly profitless, if not such as would have entailed a direct loss. Offers of such rates have been unblushingly made by persons who have thought that makers at this juncture would be prepared to accept almost any prices, but the issue has proved that this is not the case. Makers cannot now afford to send out iron that costs them more than they receive. Business must now be done in South Staffordshire on legitimate terms, and although low rates are being accepted by some makers, yet they are rates at which a profit can be made. The

absence of orders is due not so much to the period of the year as to the continued uncertainty respecting the political relations between this country and America at the beginning of next year. On that account, the preliminary meeting which was held on Thursday at Dudley was a very dull affair. The Christmas holidays prevented many from attending, and others were kept away by the knowledge that there was no business to be done.

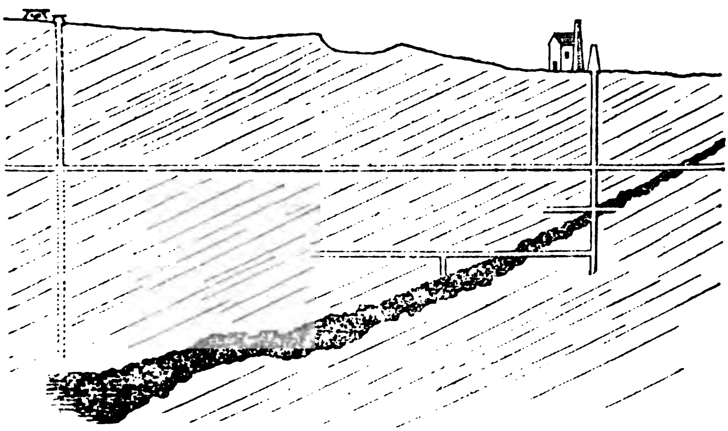
NORTH STAFFORDSHIRE.—This mining district, which is reported to have been first brought into notice by Prince Rupert, and which has long been known for the exceptional productiveness of a single mine, has within recent years been comparatively neglected, and indeed has never been tried but to a very limited extent—the explorations not extending more than 8 miles from north to south, by 4 miles from east to west.

The only mine at present of much note in the district—the Dale Mine—is in the northern part of the district, in the township of Warslow, in the parish of Alstonefield. It is bounded on the south by the once celebrated Ecton Mine, the property of the Duke of Devonshire, which in former workings yielded immense treasures of copper and lead to the Cavendish family. What these amounted to is not exactly known; but they are reputed to have reached two millions and a half. This estimate may be exaggerated; but it cannot be excessively so, for an examination of the enormous excavations shews that the returns must have been very unusual for the quantity of ground opened. The principal vein was of that character which in this district is called a "Pipe Vein,"—which seems to be formed by the concentration of a great number of cross veins in a certain run of ground:—the union of these veins forming a pipe or shoot of ore generally of great richness and value, and extending regularly to considerable depths, but having only a very limited length.

One of these "Pipe Veins"—very similar to the great Ecton Pipe—is now being worked in the Dale Mine, and its form is shown in the accompanying section of that mine given in Figure 5. The strata in which

FIG. 5.

Scale 50 fathoms to 1 inch.



it occurs is the carboniferous limestone,—the mineral character of the measures being an alternation of limestone and shale—the latter, however, frequently thinning out, or at least altering in mineral character, in depth. The beds are highly contorted, their convolutions somewhat resembling

the letter S. When the strata have this form they are locally termed saddles—"Huckle Saddles," and "Trough Saddles;" the former term being applied to the convex measures, and the latter to the concave measures. Great practical importance is attached to the relation between the veins and these two distinct forms of saddles—for in connection with them the largest deposits of ore are usually met with. The pipe vein now working in the Dale Mine is in "Saddle Ground;" and as far as yet traced it increases in size and value (as indicated in the section) as the works extend downward. Even at the present depth its full value is not known, as its whole extent is not included in the workings; but that part excavated is worth about £200 per fathom. It will be seen from the accompanying section that the present workings on this pipe are being prosecuted at an enormous disadvantage, in being pursued by workings extended from the present engine shaft, which is far behind that part of the pipe now wrought. These workings are in fact under where the new engine shaft is now being sunk, as shown by the dotted line. If this shaft were now down the ore could undoubtedly be taken away at a very fine profit; but the present difficulties, and consequent expenses, are so great that all the returns are absorbed in cost. The difficulties of drawing the stuff—of pumping the water—and of even ventilating the workings—will be readily appreciated by every one acquainted with mining, by a glance at the section; the drawing taking place through half dozen inclined winzes by hand-tackle. Nothing but a bunch of ore of extraordinary richness could pay for taking away under such enormous disadvantages; indeed, it is a matter of regret to see ore taken away at all under such circumstances, and it is only to be justified by that proverbial necessity which knows no law. Beyond this necessity, a collateral advantage may also be gained by pursuing the present course of workings on the pipe vein, if, as it is hoped, they should result in draining the water from the new shaft. This would be an immense advantage, for it would enable that important work, upon which so much depends, to be sunk not only with greater dispatch but without the expense of separate pit work.

When the shaft is communicated to the pipe vein the Dale Mine will assume a very different position, for the ore will then be in a position to be taken away at a reasonable cost, and in a fair, miner-like manner. We may state that before reaching this pipe vein, this shaft is expected to intersect another productive vein. That the present working position of this mine is not all that could be wished is evident from what we have said; but no blame, in this respect, is to be attached to the present management, for Captain Niness has left nothing undone that could be done since the management has been under his control. It certainly is unfortunate to find a mine with one of the richest courses of lead ore in the United Kingdom in such a working position as to be unable to return it to any profit. Difficulties of this kind, however, are not so very uncommon in limestone districts, where the shoots of ore—often very rich in themselves and of great regularity—dip at a moderate angle from the horizon, and having no great horizontal length, present very peculiar difficulties in working—difficulties which can hardly be appreciated by those accustomed to the metalliferous formations of killas or granite districts.

DERBYSHIRE.—The following extraordinary production of coal at the Seymour Pit, at the Staveley Collieries, is worthy of notice:—This colliery was named by Richard Barrow, Esq., the proprietor, after the name of the present resident underviewer, Martyn Seymour, Esq., who stated, at the time the colliery was being laid down, that he would not rest satisfied until the Seymour Pit produced 1,000 tons of coal per day. On Friday last, the extraordinary quantity of 1,147 tons 17 cwt. was raised without the use of more than ordinary efforts. Out of this immense quantity there were only 25 tons and 9 cwt. of slack. The pit is so laid out that the

work is performed without the slightest confusion, the men being kept well under control by the overmen, Richard Hepplethwaite and Thomas Young. It must be a source of great gratification to Mr. Barrow that Mr. Seymour has so handsomely redeemed his promise.

NORTHERN COUNTIES.

NORTHUMBERLAND AND DURHAM.—The *Colliery Guardian* correspondent reports the position of this district during the latter half of the month as follows :—Matters appear to be going on pretty much as usual, and no material alteration for either better or worse is expected for some little time to come. There is an active demand for household and gas coal, but collieries that yield other varieties characteristic of the district are doing very badly. With respect to mining operations in the great northern coal-field generally :—Hartley Pit has been flooded with water lately, but has been again re-opened. The sinking at the Bedlington new pit progresses very slowly, owing to the quantity of water met with ; this is issuing from a kind of quicksand. At the Newsham new pit a few coals are drawn daily, and it is expected to be ready for active operations early in the spring. The Bebside Colliery is one of the most extensive in the district, and 30 keels of screened coals are sent away daily, no less than 550 coal hewers being employed. Some new "winnings" are projected in this district. When the trade again revives, some movement will, no doubt, be made about them during the ensuing year. The collieries on the Wear are doing better than those in Northumberland, the gas and house coal collieries being pretty well employed. The operations underneath Lambton Castle are still in progress, for the purpose of securing the foundation of the structure, and in the course of them some curious phenomena have taken place. A bore-hole was put down from the Maudlin seam to the Hutton seam ; when it holed a great quantity of gas came off, the men had to leave the rods in the hole, and the gas soon filled the lamps at the surface. After standing three weeks, the men went down to get the rods out of the hole. After they got them out the gas came away again, and men are now watching to prevent any one going to or near the pit's mouth with a light, as the gas would ignite at once near the surface. On Saturday last very large fleets of laden colliers, which had been detained by adverse winds, put to sea, no fewer than 250 having left Sunderland alone. The exports from the Tyne during the week ending December 14, include 20,188 tons of coal, 2,481 tons of coke, 3,897 cwt. of iron, and 3,506 cwt. of alkali, showing an increase in the shipments of alkali of 2,646 cwt., and a decrease in the shipments of coal of 3,974 tons, coke 797 tons, and iron 623 cwt. Among the imports during the same period were a cargo of iron pyrites from Antwerp.

During the last week the coal trade remains dull, but the increased activity in our iron manufacturing establishments to which we alluded a week or two ago, is maintained. The chemical market, too, is a trifle better, a considerable demand having arisen for exports to France. The freight market is in a state of suspense, few shipowners appearing inclined to speculate until it is known with certainty whether we are likely to go to war with America. What with depression in trade, the open and unhealthy weather, the uncertainty of the American affair, and the melancholy death of the Prince Consort, this is the dullest Christmas we have experienced for many years. The exports from the Tyne during the week ending Saturday, the 21st December, were 27,289 tons of coals ; 3,297 tons of coke ; 3,325 cwts. of iron ; and 2,644 cwts. of alkali ; being an increase in the shipments of coal amounting to 7,051 tons, and coke to 816 tons, and a decrease in the shipments of iron of 572 cwt., and of alkali 862 cwt.

COLONIAL AND FOREIGN.

New South Wales.—The great strike among the colliers of the Newcastle coal-field, New South Wales, threatens to be attended with the most extraordinary results. The extent of this coal-field is as yet but imperfectly known. The area, however, is very large—not less, certainly, than 60,000 or 70,000 acres, and probably much more. The qualities of the coals of the different mines vary considerably, but they have all steadily risen in commercial estimation as they have become better known; and being now sent to market in a more carefully prepared state than formerly, they are fast finding their way into the Eastern, as well as Colonial ports, for steam purposes. The rate of production previous to the strike was estimated at over 300,000 tons per annum. The total number of miners employed in the district was about 900; of these about 700 have joined the present strike, of whom one-fourth have probably left the district or taken to other pursuits. The question first arose at the Minmi colliery, the property of Messrs. Brown. There had been a fall in the price of coals both at Sydney and Melbourne some time in October last, and the Messrs. Brown gave notice of a reduction of 6*d.* per ton, which at once set the men up in arms. There had been several increases of price during the twelve months preceding, inasmuch as the getting price had risen from 3*s.* 6*d.* to 4*s.* 3*d.* per ton, but the men would listen to no reason why any reduction should be made. Once a price was given, no matter from what emergency it was granted, they would not allow of its being reduced again. So they struck work, and held out for ten weeks, the society at Newcastle paying each collier one pound per week, to the number of 110 men. As the other collieries continued working, Messrs. Brown after a time had to give way. The men, elated by their success, became dictatorial, and interfered with the employment of new hands. No collier was allowed to work at any of the mines without being a member of the Union; and on any difference between employers and workmen, the latter decided the question with the ultimation "Give in or we strike." The men earned on an average from £2. 12*s.* to £2. 18*s.* per week, and might have earned from £3. 5*s.* to £3. 10*s.* This dictation went off step by step until at the present time all the large collieries in the district are stopped, including those of the Australian Agricultural Company, the Wallsend Company, the Coal and Copper Company, Tomago (Captain Williamson's) and Minmi before mentioned.

The Workmen's Union, called the "Miners' Association," has now determined upon establishing a co-operative colliery of their own. For this purpose they have taken a block of land at a royalty of 6*d.* per ton, paying £100 deposit; and they are said to have received offers of assistance from capitalists to the extent of £20,000 if required, but are determined to limit their operations to their own resources. The manager and committee will be elected by the votes of all the miners.

The capital represented by the collieries stopped by the disastrous strike amounts to some hundreds of thousands of pounds.

Since the above was written, intelligence has been received of the termination of the strike. Having lasted exactly eight weeks, it came to an end in the early part of October. With respect to the result of the contest, it appears that the wages remain very nearly the same as before the strike. A concession of 3*d.* a ton has been made by the miners, but then the employers undertake the wheeling of the coal; so that there is a compensation. The masters have failed in enforcing the reduction of 20 per cent.; and have failed also in their attempt to break up the dominating control of the union. The victory, therefore, rests with the men, and this may compensate them for the loss of two months' wages. The masters have gained nothing to compensate them for the loss of two months' profits. The only result which may be said to be adverse to the men and favourable to

the employers is one that will operate indirectly. The effect of the discussion that has taken place has been to show that the Newcastle coal-miners earn far more than the average wages of the labouring class. It has been published far and wide that in a short day's work a coal-miner can earn 11*s.* 4*d.* with ease. This is considerably above the average net earnings of gold-diggers, and is above the pay of artisans in the city. The last account of the co-operative movement states that owing to the quantity of water in the Cowper Pit, and the miners not being possessed of proper boring tools, the further sinking has been stopped for the present. Operations at the other pit were also stopped by the miners returning to their own collieries.

LABUAN COAL MINES.—From Singapore favourable accounts have been received of the prospects of the Labuan coal mines. The preparatory works have been prosecuted with energy, and the health of the island has improved. No difficulty seems to be anticipated in procuring Chinese and Malay labour, and it is probable that the coal will be raised by contract. Although the clearing out of the mine and the repairs of the old plant required to be completed, a small quantity of coal was already being regularly brought out. A new pit is to be sunk, but this will not be done until coal to some extent has been raised from the present workings. The mail of next month will bring a full report.

Mining, Quarrying, and Smelting Accounts and Meetings.

CORNWALL AND DEVON.

AT the PROVIDENCE MINES (November 27) the accounts for the three months ending October showed—Balance last audit, £235. 8*s.* 4*d.*; tin sold, £5,450. 4*s.* 10*d.*; sundries, £7. 17*s.* 6*d.*=£5,693. 10*s.* 8*d.*—Mine cost, merchants' bills, income tax and sundries, £4,105. 5*s.* 7*d.*: leaving credit balance, £1,588. 5*s.* 1*d.* A dividend of £1,120 (£1 per share) was declared, and £468. 5*s.* 1*d.* carried to credit of next account.

At the WEST CARADON MINE (November 29th) a statement of accounts for July and August showed—copper ore sold, £4,393. 5*s.* 10*d.*; carriage, £109. 9*s.* 1*d.*; materials sold, £34. 14*s.* 1*d.*; interest, £5. 10*s.* 3*d.*; income tax deducted from dues, £41. 7*s.* 11*d.*=£4,584. 7*s.* 2*d.*—Mine cost, July and August, £2,671. 19*s.* 11*d.*; merchants' bills, £712. 14*s.* 1*d.*; dues, £282. 7*s.* 2*d.*; incidental expenses, £1. 5*s.* =£3,668. 6*s.* 2*d.*: leaving balance profit, £916. 1*s.* The profit and loss account showed a balance of assets over liabilities of £5,519. 1*s.* 7*d.* The total assets, including reserve fund, and Caradon and Looe Railway stock, to be presented at the next meeting, amounted to £7,263. 14*s.* 11*d.* The profit upon the September and October workings was £957. 12*s.* A dividend of £1,024 (£1 per share) was declared, and a balance of £4,495. 1*s.* 7*d.* carried to the credit of the next account.

At WHEAL MARGARET (November 27) the accounts for the three months ending September showed—Balance last audit, £305. 15*s.* 11*d.*; tin sold, £3,558. 7*s.* 4*d.* =£3,864. 3*s.* 3*d.*—Mine cost, merchants' bills and sundries, £2,697. 10*s.* 6*d.*: leaving credit balance, £1,166. 12*s.* 9*d.* A dividend of £896 (£1 per share) was declared, and £270. 12*s.* 9*d.* carried to credit of next account.

At WHEAL HENRY meeting (December 2) the accounts showed a debit balance of £206. A call of 4*s.* per share was made.

At the BOSCEAN MINE (December 3) the accounts for the quarter ending September showed—Balance last audit, £1,085. 14*s.* 3*d.*; tin sales (less dues), £3,010. 11*s.* 3*d.*=£4,096. 5*s.* 6*d.*—Mine cost, &c., £2,741. 12*s.* 3*d.*: leaving credit balance, £1,354. 13*s.* 3*d.* A dividend of £300 (£1. 5*s.* per share) was declared, leaving £1,054. 13*s.* 3*d.* to credit of next account. Captains R. Berryman, J. Trezise and J. Rowe, reported that—"during the past quarter we have effected a considerable alteration in one of our water-stamps situated on the mine

by the erection of a new wheel, to which we have attached sixteen heads, and purpose adding immediately eight more; this will give us through a great portion of the year excellent stamping-power by means of water, and thus greatly lessen the consumption of coals at our steam-stamps."

At Wheal Basset (December 3) the accounts for September and October showed—Balance last audit, £934. 18*s.* 3*d.*; ore sold (deducting £287. 4*s.* 1*d.* dues, at 1-15th), £4,020. 17*s.* 4*d.*; sundries, £3. 2*s.* 1*d.*=£4,958. 17*s.* 8*d.*—Mine cost, merchants' bills, and sundries, £2,385. 15*s.*: leaving credit balance, £2,573. 2*s.* 8*d.* The profit on the two months' working was £1,638. 4*s.* 5*d.* A dividend of £1,024 (£2 per share) was declared, and £1,549. 2*s.* 8*d.* carried to credit of next account.

At South Crofty Mine (December 3) a call of 10*s.* per share was made.

At the Great North Downs Mine (December 4) the accounts showed—Balance last audit, £4,166. 13*s.* 10*d.*; May mine cost, merchants' bills, &c., £522. 6*s.* 5*d.*; June ditto, £400. 13*s.* 10*d.*; July ditto, £433. 14*s.* 2*d.*; August ditto, £334. 17*s.* 11*d.*; September ditto, £301. 13*s.* 11*d.*; October ditto, £299; dues, £31. 3*s.* 2*d.*=£6,490. 3*s.* 3*d.*: call, £4,250.; copper ore sold, £812. 15*s.* 9*d.*=£5,062. 15*s.* 9*d.*: leaving debit balance, £1,427. 7*s.* 6*d.* A call of £1 per share was made, 10*s.* to be paid down and 10*s.* on April 1.

At the Great Brigan Mine (December 5) the accounts showed a debit balance of £1,427. 7*s.* 6*d.* A division of the back costs was made, which amounted to a call of 5*s.* per share. The appointment of Mr. E. King as secretary was confirmed, and a committee of management appointed.

The Tincroft Mining Company declared a dividend of 5*s.* per share on December 5. This is the thirtieth dividend already paid, amounting to £10. 18*s.* 6*d*, on each £9 share.

At the South Wheal Seton (December 5) the accounts for the four months ending October showed—Balance last audit, £66. 9*s.* 11*d.*; mine cost, merchants' bills, and sundries, £803. 6*s.* 7*d.*=£869. 16*s.* 6*d.*—Calls received, £600: leaving debit balance, £269. 16*s.* 6*d.* A call of £2 per share was made. Captains Bath and Higgins reported upon the various points of operation.

At the Dolcoath Mine (December 9) the accounts for September and October showed—Balance last audit, £435. 7*s.* 9*d.*; sales of tin ore, £11,511. 19*s.*; copper, £418. 13*s.* 2*d.*; sundries, £397. 19*s.* 4*d.*; less dues and rates, £597. 2*s.* 2*d.*=£12,166. 17*s.* 1*d.* Mine cost, £5,533. 13*s.* 7*d.*; merchants' bills, £2,037. 10*s.* 11*d.*; water and other rents, £152. 0*s.* 11*d.*; balance of new engine and pitwork, £950. 19*s.*; showing a profit on the two months' working of £3,057. 4*s.* 11*d.*—By dividend of £2,864 (£8 per share), and payment of income tax on profit (£100. 8*s.* 8*d.*), leave to credit of next account £528. 4*s.*

At Wheal Seton (December 9) the accounts for September and October showed—Balance last audit, £941. 10*s.* 8*d.*; copper and tin ore sold (less dues,) £2,461. 14*s.* 4*d.*=£3,403. 5*s.*—Mine costs, including merchants' bills, £2,000. 17*s.* 5*d.*: leaving credit balance, £1,402. 7*s.* 7*d.*—By dividend, £594 (£1. 10*s.* per share), leaves to credit of next account, £808. 7*s.* 7*d.*

At Wheal Mary Ann (December 10) the accounts for the three months ending September showed—Balance last audit, £1,508. 11*s.* 2*d.*; ore sold, £5,178 10*s.* 11*d.*=£6,687. 2*s.* 1*d.*—Mine cost, merchants' bills, and sundries, £4,601. 8*s.* 9*d.*: leaving credit balance, £2,085. 13*s.* 4*d.* The profit on the three months' working was £577. 2*s.* 2*d.* A dividend of £512 (£1 per share) was declared. and £1,573. 13*s.* 4*d.* carried to credit of next account. Captains Clymo, Hodge, Harris, and Stevens reported upon the various points of operation. The stopes and pitches are producing much the same as they have for some time past.

At the Nangiles Mine (December 10) the accounts showed—Mine cost, merchants' bills, and sundries, £2,315. 13*s.* 7*d.*—Balance last audit, £117. 0*s.* 10*d.*; calls received, £1,024; ore sold, £124. 7*s.* 4*d.*: leaving debit balance, £1,050. 5*s.* 5*d.* A call of £1 per share was made. The Dublin office of reference is to be dispensed with at the end of the present month.

At Cargoll Mine (December 9) the accounts for the three months ending September showed—Balance last audit, £609. 13*s.* 6*d.*; lead ore sold, £3,189. 14*s.* 2*d.*=£3,799. 7*s.* 8*d.*—Mine cost, merchants' bills, and sundries, £3,297. 3*s.* 10*d.*: leaving credit balance, £502. 3*s.* 10*d.* The amount received for lead ore sold during the quarter has exceeded the expenditure for labour and materials, exclusive of machinery, by £424. 13*s.* 11*d.* Captains Grose and Tyzzer reported upon the various points of operations. There are 93 tons of ore sampled and ready for sale.

They have at present employed on the mine 61 men and 4 boys on tribute; 52 men and 6 boys on tutwork; 1 pitman, 7 fillers and landers, 7 enginemen, 1 carpenter, 2 smiths, 2 sawyers and a boy, 5 owners' account men, and 1 dryman; and in dressing ore 8 men, 33 boys and 15 girls; and 15 persons dressing halvans. They are progressing favourably with the erection of the engine house, on which there are 10 masons and tenders employed.

At DURLO MINE (December 10) the accounts for the quarter ending October showed—Balance last audit, £285. 5*s.* 11*d.*; sale of tin, £1,679. 2*s.* 10*d.*; sundries, £4. 8*s.* 8*d.*=£1,968. 17*s.* 5*d.*—Mine cost, £1,483. 13*s.* 3*d.*; merchants, £391. 13*s.* 1*d.*; dues and interest, £81. 16*s.* 3*d.*: leaving to credit, £11. 14*s.* 10*d.* The loss on the quarter's working was £273. 11*s.* 1*d.* Captain R. Blight was appointed a day and night agent at £7. 7*s.* per month. Captains R. James and B. Martin thus conclude their report—"This is the extent of our tutwork operations, employing 49 men; we have 20 pitches, employing 46 men: total, 95 men, at an average of 10*s.* in £1, at the present price for tin."

At the SPEARN MOOR MINE (December 13) the accounts for July, August and September showed—Balance last audit, £47. 12*s.* 7*d.*; labour cost, £981. 18*s.* 4*d.*; materials, coals, &c., £298. 17*s.* 6*d.*=£1,328. 8*s.* 5*d.*—By tin sold, at an average price of £68. 6*s.* 7*d.* per ton (less dues and income tax), £985. 6*s.* 7*d.*: leaving debit balance, £343. 1*s.* 10*d.* Captains J. Bennetts and C. Ellis reported on the mine: they have 65 men and 7 boys employed in the mine on tutwork and tribute; the tribute average is 12*s.* in £1.

At EAST CARN BREA MINE (December 17) the accounts for September and October showed—Balance last audit, £1,929. 3*s.* 10*d.*; mine cost, merchants' bills, and sundries, £1,547. 16*s.* 3*d.*=£3,477. 0*s.* 1*d.*—Calls received, £1,477. 15*s.*; copper ore sold, £1,710. 4*s.* 8*d.*: stores sold, 10*s.* 3*d.*; advance on tribute, £80: leaving debit balance, £208. 10*s.* 2*d.* Captain T. Glanville reported that their next sampling, on December 26, would be about 300 tons of copper ore; and the cost for the next two months will be about £800 per month. It was resolved that all reports forwarded to the office from the mine be in future signed by all the underground agents.

At the NORTH WHEAL BASSET (December 18) the accounts for September and October showed—Balance last audit, £387. 7*s.*; mine cost, merchants' bills, and sundries, £1,490. 0*s.* 6*d.*=£1,877. 7*s.* 6*d.*—Tin and copper ores sold and sundries, £698. 9*s.* 9*d.*; calls received, £757. 13*s.*: leaving debit balance, £421. 4*s.* 9*d.* A call of 3*s.* per share was made. Captains Glanville and Davey reported that they would sell on December 17 about £170 worth of tin ore, and on the 26th would sample about 100 tons of copper ore. Their cost for the next two months will be about the same as last—£700 per month.

At the GREAT WHEAL VOR UNITED MINES (December 18) the accounts made up to the present date showed—Audited cash account to October 31, 1861, £2,470. 4*s.*; tin sale, November 13, £1,512. 13*s.* 8*d.*; ditto, December 14, £1,612. 5*s.*; sale of plant, £115. 6*s.* 7*d.*; sundries from the mines, £15. 18*s.* 6*d.*; total, £5,726. 7*s.* 9*d.* And paid: October cost, £1,155. 5*s.* 11*d.*; sundries, £3. 17*s.* 2*d.*=£1,159. 3*s.* 1*d.*—Balance (cash and bills), £4,567. 4*s.* 8*d.* The actual account as it stands this day is as follows:—Assets; Balance as above, £4,567. 4*s.* 8*d.*; arrears of call, £12. 0*s.* 8*d.*; materials sold, £264. 4*s.* 3*d.*= £4,843. 9*s.* 7*d.* Liabilities: November cost, £1,243. 13*s.* 7*d.*; sundries (say), £200=£1,443. 13*s.* 7*d.*—Balance in favour of mines, £3,399. 16*s.* The committee add that, under the circumstances of so large an amount of work done, and that a distribution of 12*s.* 6*d.* per share has been divided amongst the shareholders, the present financial position may be considered highly satisfactory, and they venture to hope, from the present favourable prospects of the mine, to be able to recommend a dividend to the shareholders at the next meeting.

At BEDFORD UNITED MINES (December 19) the accounts for the three months ending October showed—Balance last audit, £1,105. 14*s.* 1*d.*; ore sold and sundries, £3,531. 11*s.* 5*d.*—£4,637. 5*s.* 6*d.*—Mine cost, merchants' bills, and sundries, £3,168. 5*s.* 6*d.*: leaving credit balance, £1.469. A dividend of £600 (3*s.* per share) was declared, and £896 carried to credit of next account. Mr. Wolferstan and Captain Phillips reported that, according to their present prospects and the value of the load in the western part of the mine, the usual returns can be made without diminishing the reserves.

At GREAT SOUTH TOLGUS MINE (December 19) a dividend of 5*s.* per share was declared, after payment of which there remains a balance of £1,813. 9*s.* 7*d.*

in cash, and £1,903. 2*s*. 10*d*. ore bills not at maturity, applicable to the general purposes of the mine.

At the Trevenen and Tremenheere Mine (December 19) the accounts showed—Balance last audit, £1,306. 15*s*.; May mine cost, £555. 11*s*. 6*d*.; June, £559. 0*s*. 11*d*.; July, £605. 4*s*. 11*d*.; August, £558. 6*s*. 7*d*.; September, £574. 6*s*. 6*d*.; October, £578. 7*s*. 6*d*.; London agency (six months), £18. 18*s*.; expenses of general meeting held at Helston, bankers' charges for interest and commission, £81. 3*s*. 10*d*.; dues, £103. 5*s*. 5*d*.=£4,941. 0*s*. 2*d*.; calls received, £1,170. 10*s*. 6*d*.; tin sold, £1,858. 17*s*. 11*d*.=£3,029. 8*s*. 5*d*.: leaving debit balance, £1,911. 11*s*. 9*d*. A call of 7*s*. per share was made payable in two instalments.

At the North Downs Mine (December 20) the accounts showed—Balance last audit, £1,294. 1*s*. 7*d*.; materials sold, £12. 16*s*. 5*d*.; copper ore sold, £4,986. 12*s*. 8*d*.; club account, £2. 16*s*.; income tax, £11. 0*s*. 8*d*.=£6,307. 7*s*. 4*d*. Dividend last meeting, £750; mine cost, July to October, £2,116. 17*s*. 7*d*.; merchants' bills, £956; dues, £249. 6*s*. 7*d*.; interest account, £10. 17*s*. 11*d*.; incidental expenses, £1. 5*s*.; law charges, £16. 1*s*. 8*d*.=£4,100. 8*s*. 9*d*.: leaving credit balance, £2,206. 8*s*. 7*d*. A dividend of £1,500 (5*s*. per share) was declared, leaving a balance of £706 to be carried forward to the credit of the next account.

At Carnyorth Mine (Dec. 16) the accounts for July, Aug., and Sept. showed —Mine cost, £1,424. 15*s*. 9*d*.; merchants' bills, £232. 1*s*. 5*d*.; coal, £126. 11*s*. 9*d*.; lords' dues, £64. 0*s*. 5*d*.=£1,847. 9*s*. 4*d*.—Received for tin, £1,536. 11*s*. 7*d*.; sundries, £7. 10*s*.—making loss on the quarter's working, £303, 7*s*. 9*d*., which added to debit at last audit, leaves £1,271. 8*s*. 2*d*. now against adventurers. A call of 5*s*. per share was made. Capts. J. Carthew, W. Trembath, and J. Wallis reported on the mine.

At the Great Wheal Busy United meeting (Dec. 23) the statement of accounts for the three months ending Oct. showed:—

Aug. mine cost, merchants' bills, &c., £3,420. 15*s*. 8*d*.; Sept. ditto, £2,916. 9*s*. 4*d*.; Oct. ditto, £3,032 10*s*. 4*d*.=£9,369. 15*s*. 4*d*. Balance last audit, £284. 13*s*. 7*d*.; Copper ore sold, £6,297. 13*s*. 4*d*.; Tin sold, £2,520. 15*s*. 5*d*.=£9,103. 2*s*. 4*d*. Balance (debit), £266. 13*s*.

A very satisfactory report was received from the manager. An analysis of the accounts showed a profit on Wheal Busy alone of £1,600 for the quarter.

At Hingston Down Consols (Dec. 24) the accounts for the two months ending October showed—Balance last audit, £76. 19*s*. 1*d*.; ores sold, £1,158. 17*s*. 7*d*.; calls received, £260. 1*s*. 6*d*.; carriage, £128. 9*s*. 11*d*.=£1,624. 8*s*. 1*d*.—Mine cost, merchants' bills, and sundries, £1,526. 19*s*. 7*d*.: leaving credit balance, £97. 8*s*. 6*d*. Captain T. Richards reported that the sampling on December 31 will be about 360 tons of fair quality ore, and, on the whole, he considers their present prospect very encouraging. The cost for the ensuing two months, including the new and Bailey's engine-shafts, will be about £1,600.

WALES.

At Mount Pleasant Lead Mine meeting (Dec. 6) the accounts for the five months ending November showed—Balance last audit, £313. 9*s*. 6*d*.; lead ore sold, £3,622. 10*s*.=£3,935. 19*s*. 6*d*.—Mine cost, merchants' bills, royalty, and sundries, £1,516. 0*s*. 7*d*.: leaving credit balance, £2,419. 18*s*. 11*d*. The profit on the five months' working was £2,106. 9*s*. 5*d*. A dividend of £800 (£1. 5*s*. per share) was declared, and since the last meeting four monthly dividends, amounting to £1,600 (£2. 10*s*. per share) have also been declared, leaving now £19. 18*s*. 11*d*. to the credit of next account. Captain Robert Williams reported upon the various points of operation. He considers that the mine has never been so rich during his agency as it is at present.

IRELAND.

At the General Mining Company for Ireland (Dec. 2) the accounts for the half-year ending Oct. 2 showed—Balance last audit, £4,252. 1*s*. 2*d*.; ore sold, £725. 11*s*. 3*d*.; transfer fees and sundries, £31 10*s*. 5*d*.=£5,009. 2*s*. 10*d*.—Mine cost, merchants' bills and sundries, £3,405. 13*s*. 5*d*.: leaving credit balance £1,603. 9*s*. 5*d*. Captain W. G. Roberts reported upon the operations at the mines. The dressing of the calamine is going on well, and arrangements have been made for saving the ochre, a ready sale for which it is expected will be found.

At the CROOKHAVEN MINE annual meeting (Dec. 23) the accounts made up to November showed a balance in favour of assets of £942. The uncalled capital amounted to £9,831.

COLONIAL AND FOREIGN.

At the half-yearly meeting of the ST. JOHN DEL REY MINING COMPANY, (December 13), Mr. John Hoskin (managing director) submitted the report of the directors. The season had, on the whole, been favourable, and an unusually large produce of gold has been the result. The monthly returns have been as follows:— March (12 days) 18,634 oits.; April, 38,663 oits; May, 41,144 oits; June, 42,086 oits.; July, 45,106 oits.; August, 46,142 oits., September (18 days), 25,517 oits.: giving a total of 257,292 oits. for 183 days. The produce for the six months immediately preceding the period now reported on (comprising 180 days) was 227,446 oits.; whilst that of March to September, 1860 (comprising 186 days), was 200,720 oits. The mean daily production of gold during these three half-yearly periods has thus been—

During the six months ending	September 18, 1861	1,406 oits per diem.
,, ,,	March 19, 1861	1,236 ,,
,, ,,	September 20, 1860	1,079 ,,

The profit on the working of the mines for the past half-year, as shown by the company's books in London, has been £41,978. 11s. 5d., adding thereto the amount received for interest on moneys unemployed, and deducting income tax and London expenses, there remains a net profit of £40,530. 13s. 9d., out of which the directors beg to recommend to the meeting the declaration of a dividend at the rate of 60s. per share. free of income tax. The amount of 10 per cent. thereon will be added, as usual, to the reserved fund. This proposition, after some discussion, was adopted by the meeting.

The quantity of stone raised from the mine during the half-year was 48,756 tons, against 47,087 tons in the preceding six months. The quantity of stone stamped during the half-year was 35,949 tons, against 35,341 tons in the preceding six months. The quantity of stone rejected during the half-year was 12,460 tons, against 11,259 tons in the preceding six months. The yield of gold per ton of stone during the six months has been as follows:—

	Tons.	Oits. per ton.
On the whole quantity raised	48,756	5·276
,, ,, stamped	35,949	7·157

During the preceding six months the yield was—

	Tons.	Oits. per ton.
On the whole quantity raised	47,087	4·830
,, ,, stamped	35,321	6·439

showing an increased yield of over 4-10ths of an oitava per ton of ore raised, and about 7-10ths of an oitava per ton of ore stamped.

The following is the financial position of the Company at the close of the half-year, on November 30:—

IN ENGLAND.

Balance at the bankers	£ 2,371	10	3			
In deposit with London Joint-Stock Bank	54,000	0	0	=£56,371	10	3
To Pay: Draft running (due December 15)	55	0	0			
Income tax on last year's profits	2,277	3	7			
Dividend now proposed	33,000	0	0			
To reserved fund thereon 10 per cent	3,300	0	0	= 38,632	3	7

IN BRAZIL.

On dispatch of advices of September 28, from Morro Velho, and October 8, from Rio:—

Cash at Morro Velho	Rs. 36,984=$433
In transit to Morro Velho	15,000=$000
Cash at Rio	40,245=$340=Rs. 92,229=$773

Which, at the exchange of 2s. 1¼d. per real, is equal to £9,703. 6s. 9d., to meet the expenditure of September and October—(say) £18,000.

At the PACHUCA SILVER MINE (annual) meeting, on December 16, Mr. G. F. Smith (the secretary) read the advertisement convening the meeting. The report of the directors congratulated the shareholders upon the satisfactory manner which the prosecution of the works had been carried on at Pachuca, by Capt. Paull.

During the year, San Juan shaft, below San Juan level, had been sunk and secured nine varas; the adit level east of shaft had been driven 90 varas; the San Juan level, east of shaft, had been driven 93 varas, and Las Animas winze had been sunk 12 varas. The Tapona lode, in the adit level, is 12 feet wide, very promising, and producing good stones of ore, some assaying over 112 ounces of silver to the ton. It was expected that in a very short period the junction of the Tapona with the Vizcaina would be reached. The Tapona lode in the San Juan level also presented every appearance of a rich lode, and as that level was 20 varas deeper than the adit, it was expected that metal of a good ley would be found on arriving at the junction. At the bottom of the San Juan shaft stones of ore had recently been obtained which assayed 929 ounces of silver to the ton. In accordance with the resolution passed at the last general meeting, the directors had secured for the company the valuable sett of San Luis Mine, which adjoined, and was held upon the same terms as the Santa Elena Mine. Some very promising stones of ore had been found in the lode leading towards the great Vizcaina vein. From the results in the working, and the indications presented at both mines, the directors believe that the time was speedily arriving when they would have the further pleasure of congratulating the shareholders upon the complete success of the undertaking. In order to show the value of the properties, and the high estimation in which they were held by mining men in the neighbourhood, the directors might mention that since the formation of the present company parties had taken up and were working the ground both to the east and west of these mines.

The balance-sheet, made up to the end of October, showed that the cost incurred in working the Santa Elena Mine during the year amounted to £1,610. 0*s*. 7*d*.; and the sum expended upon the works in the San Luis Mine amounted to £268. 7*s*. 5*d*. In the bankers' hands in London there was cash amounting to £1,693; and in Mexico to £746.

At the Central American Mining Company meeting, on December 18, Mr. John Phillips (the secretary) read the report of the directors, which was of a very favourable character, fully confirming the high opinion which has been entertained of the value of the mine. The returns for the twelve months ending August was £21,401, whilst the aggregate expenditure had been £21,703, which showed a slight excess of cost over returns. The cost, however, included salt, quicksilver, and other stores. Again, there would be observed in the accounts the item premium on silver coin, an item which would probably not occur again, as the Company were now sending silver to the mint at Guatemala and receiving coin in exchange. The directors saw reason to think that the time was not far distant when they would be able to set aside a fund for distribution amongst the shareholders. Upon the conclusion of his term of agreement Mr. Ellery had returned to England, but a fresh arrangement had been entered into with him, and he would be back in January.

The following dividends have been declared during December:—

West Wheal Seton	£8	0	0	£3,200	0	0
Dolcoath	8	0	0	2,864	0	0
Great South Tolgus	0	5	0	1,500	0	0
North Downs	0	5	0	1,500	0	0
Tincroft	0	5	0	1,500	0	0
Wheal Basset	2	0	0	1,024	0	0
Mount Pleasant	1	5	0	800	0	0
Bedford United	0	3	0	600	0	0
Wheal Seton	1	10	0	594	0	0
Wheal Mary Ann	0	10	0	512	0	0
Orsedd	0	1	3	320	0	0
Boscean	1	5	0	300	0	0
St John del Rey	3	0	0	33,000	0	0
Total				£47,714	0	0

Prices Current of Metals.

		Per Ton.		
IRON	Bars ... in Wales ...	£5 2 6	@	£5 5 0
	,, ... ,, Liverpool	......		5 15 0
	,, ... ,, London..	6 0 0	,,	6 5 0
	Nail Rods ... ,, Wales ...	5 12 6	,,	5 15 0
	,, ... ,, Liverpool	6 10 0	,,	7 5 0
	,, ... ,, London..	7 5 0	,,	7 15 0
	Hoops (Staffordshire) ,, Liverpool	7 15 0	,,	8 10 0
	,, ,, ,, London..	8 5 0	,,	8 15 0
	Sheets ,, ,, Liverpool	8 10 0	,,	9 5 0
	,, ,, ,, London..	9 0 0	,,	9 15 0
	Bars ,, ,, Liverpool	7 0 0	,,	8 0 0
	,, ,, ,, London..	7 10 0	,,	8 10 0
	Scotch Pig (No.1.g.m.b.) the Clyde	2 9 0	,,	2 10 0
	Rails ... in Wales.	5 0 0	,,	5 5 0
	Russian ... C.C.N.D	16 0 0	,,	16 10 0
	Swedish—Hammered—large sizes .	11 10 0	,,	11 15 0
	,, ,, Indian sizes	11 10 0	,,	11 15 0
STEEL	Hammered—faggot ...	......		16 10 0
	,, in kegs ½ and ⅝ in. ...	......		15 10 0
COPPER	Australian and other *fine* Foreign..	104 0 0	,,	107 0 0
	Foreign Slab, for Prod. 96 per Cent.	93 0 0	,,	94 0 0
	English Tile and Tough ...	105 0 0	,,	107 10 0
	,, Best selected ...	108 0 0	,,	110 10 0
		Per lb.		
	,, Sheets, Sheathing and Rod	11¾*d.*	,,	12*d.*
	,, Flat Bottoms ...	12¼*d.*	,,	12½*d.*
YELLOW METAL	Sheets, Sheathing and Rod...	9½*d.*	,,	10*d.*
		Per Cwt.		
TIN English	Common Blocks and Ingots...	......		120*s.*
	,, Bars (in barrels) ...	......		121*s.*
	Refined ...	......		122*s.*
Foreign	Straits ...	118*s.*	,,	120*s.*
	Banca ...	......		121*s.*
		Per Box.		
TIN PLATES at Liverpool 6d. Less.	Charcoal IC ...	28*s.*	,,	29*s.*
	,, IX ...	34*s.*	,,	35*s.*
	Coke IC ...	22*s.*6*d.*	,,	23*s.*
	,, IX ...	28*s.*6*d.*	,,	29*s.*
		Per Ton.		
LEAD	Sheet ...	......		20 10 0
	Pig—W.B. ...	......		21 10 0
	,, ordinary brands ...	......		20 5 0
	,, Foreign, soft ...	......		19 15 0
	Red ...	......		21 10 0
	Shot ...	......		23 0 0
	Dry White ...	......		27 0 0
SPELTER	(Cake) ...	£17 0 0	,,	17 5 0
ZINC	(Sheet) ...	......		24 0 0
		Per Bottle.		
QUICKSILVER	(in bottles containing 75 lbs. each)	......		7 0 0
		Per Ton.		
REGULUS OF ANTIMONY, French Star	...	......		47 0 0

Quotations mostly nominal.

Metal Markets.

THE following is condensed from the very excellent Review on the metal market for the past year, which appeared in the last issue of the *Mining Journal*.

The expectations so generally entertained at the expiratibn of 1860 that the present year would prove to be commercially a most prosperous one have certainly not been realised.

IRON.—The dulness of trade during the year has been felt very severely by the ironmasters, and for the most part their selling prices are stated to be less than the cost of production; this is more particularly the case in railway and merchant bars. For rails the demand has been extremely limited. One of the greatest outlets for this description of iron was America, whose immense lines have helped to keep our manufacturers well employed for several years past, and now the falling off, on account of the prohibitive duty levied, has caused great depression. Prices of rails have undergone but slight fluctuations, only varying from £4. 17*s*. 6*d*. to £5. 5*s*. at the works. The higher rate was barely maintained at any period.

Merchant bars from £6. 10*s*. in January fell to £5. 15*s*. in July and August; since, a slight improvement has been maintained, and £5. 17*s*. 6*d*. to £6 is now quoted, f.o.b. in London. North of England bars can be bought in quantities at £5. 15*s*. Staffordshire makers have been obliged during several months to work short time, and at the half-yearly meeting a fixed reduction of 10*s*. per ton in price was agreed upon. Swede bars in the early part of the year were tolerably active at £11. 5*s*. to £11. 10*s*., but decreased in value some 12 or 13 per cent. about July. Scotch pigs, in proportion with the price of manufactured iron, have ruled high. In January mixed numbers were quoted at 49*s*.; March, 47*s*. 6*d*.; August, 51*s*. 9*d*., declining again to 48*s*. 3*d*., on account of the American affair. The last day or two there is a slight recovery, sellers quoting 48*s*. 7½*d*. to 48*s*. 9*d*. cash, mixed numbers.

STEEL.—The demand for English descriptions has been limited. In Swedish keg, excessive stagnation marked the trade for the first nine months of the year, and the price has fallen considerably below the average of the last 10 years,

COPPER.—The business transacted during the year in English descriptions has been extensive; but anything but remunerative to the smelters, the standard by which they purchased ores having been proportionately high above the price of the manufactured article; they have been obliged, and in many cases, to take contracts on terms resulting in possitive loss to themselves. The fixed price of sheets, sheathing and bolts was, during January, February and the greater part of March, 11½*d*. per lb.; but, as the demand gradually decreased and underselling became the rule, a reduction of ½*d*. per lb. was submitted to; this price (11*d*.) remained with a fair enquiry up to about the middle of May, when the market became dull, and several second-hand lots were offering under price. On the 24th June a further reduction of ½*d*. per lb. took place, making quotations 10½*d*. per lb. for manufactured and £93 for cake and tile; but difficulty was experienced in realising at even ½*d*. under this price, a very large quantity being held in second hands. For nearly ten years previously so low a figure had not been touched. Eventually a better feeling was manifested, and a good enquiry sprung up. The standard of ores advanced steadily at each successive ticketing; but not until the middle of August was any advance made in fixed rates, and then only ½*d*. per lb. This, however, had the effect of increasing the demand. A large business was done, and prices were well maintained up to about the middle of October, when a falling off was visible, and much less activity prevailed; just then, very unexpectedly, the smelters announced a further rise of £5 per ton. This was done apparently only to keep pace with the rising standard, as copper was but in limited request at that time. An improvement in the demand for India caused a further rise to 12*d*. on the 25th of November, since which parcels in second hands have been offering under price, and our market, owing to the American difficulty, closes in a nominal state. Burra Burra has varied from £92 to £104 per ton, lowest prices ruling in July and advancing with English. Kapunda has sold freely, value closely approximating to Burra. Chili has been bought largely, and the stocks much diminished, owing to the supplies this year being considerably under last year's importations. Prices have varied from £82 to £94. Several parcels of Spanish, of various brands, have arrived and met with ready sale, quotations varying from £82 to £93. Large quantities of Baltimore have been shipped from America to this country and the Continent, which has operated most

unfavourably upon this as well as upon the continental markets. Orders lately have been received for the whole quantity remaining in first hands to be returned, and some shipments have already been made.

TIN.—For more than two years past this metal has been on the decline, until the last three or four months, when a decided reaction set in, and prices once more assumed an upward tendency, which, however, at the present unfortunate juncture shared the fate of all other metals. Quotations for English declined in the first part of the year, January to August, from £132 to £114, at which price they began to improve. In foreign the deliveries of Banca have been very large, and the supplies for the ensuing year are expected to be rather short of 1861. Prices have varied about £16 per ton. In straits arrivals are much larger this year than hitherto, and, judging from stocks, the market is not very promising. It is, however, chiefly held in strong hands, and therefore is not likely to be sacrificed. Last business reported £118.

LEAD.—During the year prices of this metal have reached a lower point than for the last ten years. Early in this year the exports of English pig, especially to China, were large, and prices maintained with firmness at £21. 5*s*. This demand falling off the market declined to September (lowest point £18. 15*s*.), when the demand began to improve, and sellers held for higher rates. A comparatively large business was about this time transacted, and £20 is now quoted. Sheet, shot, and other descriptions have been but slightly in request all through the year. The imports of Spanish pig have been large, and prices ruling in proportion to English. German, of soft quality and known brands, disposed of freely at £18. 10*s*. to £19. The demand in Germany for direct shipments to America, however, maintains prices beyond present quotations of English.

SPELTER.—Prices during this year have reached a lower minimum than since 1852—viz., £16. In 1857 the quotation advanced to £30. 17*s*. 6*d*., or very nearly double. Large quantities have at different periods changed hands; these sales, however, have been entirely on speculation—deferred prompts, distant arrivals, &c., being used to create a species of time bargaining. The American news has depreciated the value of spelter 30*s*. or 40*s*. per ton, equal to 10 per cent. The present stocks held in London amount to upwards of 5000 tons, and are still increasing.

Metallic-Ore Markets.

TIN.—At the beginning of the month, the standards for black tin were:—

Refined ... £114

Common ... 109, and, from the buoyancy of the market, a rise was daily expected. The *Trent* affair, however, altered all this; and, instead of a rise, we have had a fall during the last week of the month of £2, the standards being now quoted at—

Refined ... £112

Common ... 107. This drop, which makes a total of £5 since June, will be severely felt by the Cornish tin mines.

COPPER.—At the four Cornish sales of the month, the average produce price per ton, and standard, have been as follows:—

	Produce.	Price per Ton.	Standard.
Dec. 5	6¼	£5 14 0	£136 2 0
„ 12	6½	5 9 6	132 12 0
„ 19	5⅜	4 11 6	135 12 0
„ 26	5¾	4 16 0	132 7 0

We have already (see note, page 28) expressed our opinion as to the entire uselessness of the standard, as even indicating how the prices of ores have gone, which we may instance by taking the average standards of the sales of the 12th and 19th, which show a nominal advance of £3,—whereas there has actually been no advance in the prices of the ores. Consequently, to find how these prices have really gone, a supplementary calculation is made. A good deal of misapplied ingenuity has been expended on this

subject, but, it would seem, to no good purpose, for the adepts in calculating this "supplementary standard" differ very widely—which is not very much to be wondered at. For instance: let us take the above sales: in calculating the "supplementary standard" of the sale of the 5th, compared with that of the previous week, the *Mining Journal* makes out that it has remained stationary, while, according to the *West Briton*, it fell 21*s*. In the sale of the 12th again, according to the *Mining Journal*, the decline was £2, while the *West Briton* makes it £3. 9*s*. Similarly as to the standard of the sale of the 19th, the *Journal* makes the decline £1. 10*s*., and the *West Briton* £2. 3*s*.; while, in that of the 26th, the former makes the fall £1. 10*s*., and the latter only 6*s*.

We have not the least intention of following either of these authorities into their calculations; they each have their partisans, who are satisfied with their respective conclusions. As will be seen from the explanation extracted from Dr. Percy's "Metallurgy," the copper standard is at present a mere myth, and we have no confidence in any calculation founded on such a basis. Besides, the whole affair is a work of the most complete supererogation. The common-sense fact, that ores averaging such and such a produce realized an average price of so much per ton, is mystified by calculating an imaginary standard, which, as it stands, admittedly conveys no distinct idea; and a supplementary calculation is instituted to bring this back to common sense again—that is, to the point started from before calculating the standard—by a muddling calculation which necessarily results in confusion.

The real object of all this arithmetical circumlocution—the comparison of the prices realised by ores at different sales according to their produce —is easily arrived at, without any of this confusion or complication, by comparing the average produces and average prices realised at each sale. Of course, a slight allowance must be made according to what the produces are; but this is the only common-sense method of proceeding, and is comprehensible in a moment to every one who can do a rule of three sum. We cannot enter into the matter further this month, but a glance at the average produces and prices per ton given above, shows that a heavy fall took place between the first and second sale of the month, and a slight decline subsequently.

In the Swansea copper ore circular no average standard is calculated, nor is the average produce either. The abandonment of the standard here is the best evidence of the estimation in which it is held by those most capable of judging. The produces of the ores sold at Swansea differ so widely that in their case a calculated average produce is of no value, particularly as the produce of each parcel is given in the circular, which is not done in the Cornish ticketing paper. A comparison of the prices realised by ores of a similar or nearly similar produce, at the Swansea sales of the 10th and 24th, shows at once a fall in prices between these two sales.

LEAD.—The fall in the prices of lead ores still continues; a comparison between the latest sales of November and December showing a further decline of from 10*s*. to 15*s*. per ton of ore. This is becoming very serious for the lead mining districts, and must be severely felt in large-producing mines.

Copper Ores,

Sampled Nov. 20. and sold at Tabb's Hotel, Redruth, Dec. 5.

Mines.	Tons.	Purchasers.	Price.
Clifford Amalgamated	113	3	£6 9 6
(Wheal Clifford)	112	4	6 8 0
	110	7	6 11 0
	105	2,7	6 9 0
	95	2	4 14 6
	84	2	4 6 6
	83	3	15 18 6
	74	7	5 17 0
	72	7	3 14 0
	71	4	7 19 0
	47	4	7 7 0
	19	2	4 12 6
Engine ore.........	62	2,7	8 1 0
West Seton..................	91	8	5 9 0
	90	4	7 7 6
	88	4,8	10 0 0
	80	10	8 16 6
	69	4	8 11 6
	68	4	6 16 6
	61	8	2 19 6
	53	14	2 18 0
	41	8	6 12 0
Tincroft	80	2	1 1 6
	60	10	2 19 6
	58	10	2 16 0
	57	10	5 7 0
	56	10	5 7 6
	46	14	3 4 6
	29	2	11 10 6
	20	10,11	2 3 6
East Pool	75	14	4 13 0
	62	9	3 10 0
	57	14	3 14 6
	55	8	4 15 0
	40	2	0 12 6
	37	5,7,8	5 0 0
	28	9	4 3 6
	20	14	2 6 0
Wheal Basset	99	6	6 16 0
	82	8	6 19 6
	80	7	9 15 0
	57	6	5 10 0
	26	11,14	2 3 0
Wheal Basset	20	6	£16 2 0
Wheal Seton	69	11	1 6 6
(Pendarves)	67	8	5 11 6
	60	8	6 7 0
	42	7	6 17 0
	38	8	5 11 0
	30	11	2 14 6
	29	7	13 14 6
Condurrow..................	94	7	2 19 0
	65	7,8	2 10 6
	50	3	6 2 0
	45	7	7 16 6
	28	9	0 7 6
	21	8	2 16 6
South Frances	91	6	5 7 6
	47	10	10 0 0
	45	7	5 7 6
	30	6	5 6 6
	7	14	3 14 0
South Tolgus	80	3,7	11 1 0
	53	8	4 10 0
	50	11	4 9 6
East Bassett	76	2	5 3 6
	58	2,6,10	6 1 6
	27	2,6	11 10 0
New Treleigh	61	9	3 10 0
	46	9	3 10 0
	28	7,9	8 8 6
Camborne Vean	57	4	7 3 6
	54	14	2 4 6
	23	4	1 0 0
Stray Park..................	66	10	3 6 6
	35	9	0 10 0
	22	3	11 0 6
Dolcoath.....................	41	10	5 0 6
	31	11	2 7 6
West Tolgus	63	8	4 16 0
South Crofty...............	25	2,4	1 1 6
	20	10,11	6 17 0
	13	9	2 19 6
South Basset.......... ...	38	11	3 5 0
Carn Camborne	17	6	5 9 6
	5	2	1 13 6

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.
Clifford Amalgamated.........	1047	7,176 7 0
West Wheal Seton..............	641	4,407 5 0
Tincroft............................	406	1,558 18 6
East Pool..........................	374	1,412 4 6
Wheal Basset.....................	364	2,716 11 0
Wheal Seton	335	1,824 6 6
Condurrow	303	1,168 7 6
South Wheal Frances.........	220	1,386 13 0
South Wheal Tolgus...........	183	1,346 5 0
East Wheal Basset	161	1,056 3 0
New Treleigh	135	610 8 0
Camborne Vean.................	134	552 2 6
Stray Park........................	123	479 10 0
Dolcoath	72	279 13 0
West Wheal Tolgus	63	302 8 0
South Wheal Crofty...........	58	202 11 0
South Wheal Basset...........	38	123 10 0
Carn Camborne..................	22	101 9 0

EACH COMPANY'S PURCHASE.

	Tons.	£	s.	d.
1 Mines Royal Co............	—	—		
2 Vivian and Sons............	557	2,621	5	3
3 Freeman and Co	308	3,043	0	0
4 Pascoe Grenfell and Sons	593½	4,231	12	9
5 Crown Copper Co.........	12½	61	13	4
6 Sims, Willyams and Co..	347	2,323	7	0
7 Williams, Foster and Co.	763½	5,018	13	7
8 Mason and Elkington...	721	3,930	12	1
9 F. Bankart......	287	893	0	6
10 Copper Miners' Co.........	504	2,756	0	6
11 C. Lambert..................	251	712	5	0
12 Newton, Keates & Co.....	—	—		
13 Alkali Co..	—	—		
14 Sweetland Tuttle and Co	325	1,083	2	6
	4,679	£26,704	12	6

Average produce, 6¼.
Quantity of fine Copper, 290 tons 14 cwt.

Average standard, £136 2s. 0d.
Average price per ton £5 14s. 0d.

Copper Ores,

Sampled Nov. 27, and sold at Tabb's Hotel, Redruth, Dec. 12.

Mines.	Tons.	Purchasers.	Price. £	s.	d.
West Basset	88	6	£6	5	6
	82	10,11	4	2	6
	80	10	4	15	6
	75	10	6	4	6
	69	8	4	19	0
	68	8	5	5	0
	42	8	7	0	0
	32	6	5	1	6
	16	6	2	17	0
Carn Brea	122	2	0	4	6
	64	3,7	5	19	6
	58	6	6	16	0
	57	11	2	8	0
	55	14	3	9	6
	46	11	2	8	0
	44	3,7	5	1	0
	38	4	8	1	6
	37	11	4	15	0
Great Wheal Alfred	67	8	4	0	6
	65	7,8	2	16	6
	60	8	2	19	6
	50	7	2	16	6
	43	2,7	3	0	6
	35	14	3	10	6
	24	8	1	12	0
	16	3	13	7	0
Par Consols	77	3	8	10	6
	73	6	10	19	6
	68	10	7	5	0
	35	14	4	0	0
Pendeen Consols	107	2	2	10	6
	55	2	3	6	6
	50	2	2	17	6
	3	2	25	10	0
Great South Tolgus	64	7	6	0	6
Great South Tolgus	63	4,7	9	15	6
	51	4	9	1	6
	35	4	9	11	0
Charlotte United	63	6	9	4	6
	46	6	8	14	6
	42	9	6	18	0
Rosewarne United	60	7	7	15	6
	52	7	11	18	6
	37	6,7	4	13	0
Wheal Buller	57	10	3	4	0
	46	2	0	4	6
	29	8	10	8	6
Copper Hill	53	11	2	1	6
	45	8,11	5	10	6
	25	4	16	12	0
Wheal Anna	75	3	3	6	6
	28	6	1	13	6
Treloweth	46	10,11	7	7	6
	21	9	7	18	6
	20	8	14	14	6
Prideaux Wood	60	9	2	18	6
Wheal Unity Consols	32	8	4	6	0
Mines Royal Co.'s Ore	25	11	4	13	6
	3	6	3	19	0
Pend-an-drea	16	11	3	11	0
	7	8	12	19	6
Rosewarne Consols	11	8	7	4	0
	3	6,14	0	17	6
Trevoole	12	8	3	1	6
Boscaswell Downs	12	2,6	14	0	6
South Dolcoath	12	2,6	18	10	6
Camborne Consols	10	6	7	2	0
Wheal Grylls	7	2	3	15	0
Goonzion	4	6	8	16	6

TOTAL PRODUCE AND VALUE.

	Tons.	Amount. £	s.	d.
West Basset	552	£2,939	17	6
Carn Brea	521	1,947	7	6
Great Wheal Afred	360	1,278	10	0
Par Consols	253	2,090	12	0
Pendeen Consols	215	673	6	0
Great South Tolgus	213	1,798	10	0
Charlotte United	151	1,272	6	6
Rosewarne United	149	1,258	13	0
Wheal Buller	132	495	1	6
Copper Hill	123	773	12	0
Wheal Anna	103	296	5	6
Treloweth	87	800	3	6
Prideaux Wood	60	175	10	0
Wheal Unity Consols	32	137	12	0
Mines Royal Ore	28	128	14	6
Pend-an-drea	23	147	12	6
Rosewarne Consols	14	81	16	6
Trevoole	12	36	18	0
Boscaswell Downs	12	168	6	0
South Dolcoath	12	222	6	0
Camborne Consols	10	71	0	0
Wheal Grylls	7	26	5	0
Goonzion	4	35	6	0

EACH COMPANY'S PURCHASE.

	Tons.	Amount. £	s.	d.
1 Mines Royal	—	——		
2 Vivian and Sons	423½	997	13	9
3 Freeman and Co.	222	1,421	14	0
4 Grenfell and Sons	180½	1,826	16	9
5 Crown Copper Company	—	——		
6 Sims, Willyams and Co.	453	3,385	19	9
7 Williams, Foster & Co.	384	2,466	10	9
8 Mason and Elkington	496	3,636	12	0
9 F. Bankart	123	631	14	6
10 Copper Miners' Compy.	344	1,863	0	6
11 Charles Lambert	320½	1,169	13	3
12 Newton, Keates and Co.	—	——		
13 Alkali Company	—	——		
14 Sweetland and Co.	126½	455	16	3
	3073	£16,855	11	6

Average produce, 6¼.
Quantity of fine Copper, 190 tons 16 cwts.

Average standard, £132 12s. 0d.
Average price per ton, £5 9s. 6d.

Copper Ores,

Sampled Dec. 4, and sold at the Royal Hotel, Truro, Dec. 19.

Mines	Tons.	Purchasers.	Price.		
Devon Great Consols...	135	6	£4	9	6
	125	6	10	16	0
	118	10	4	16	0
	117	3	5	4	6
	114	7	4	2	6
	109	6,11	4	12	6
	108	14	2	12	6
	105	10	3	12	6
	102	10,11	4	5	0
	100	9	5	6	0
	99	7	10	9	6
	97	11	4	16	6
	94	11	3	13	6
	93	6,11	2	6	0
	92	11	3	13	6
	90	11	4	15	0
	85	11	1	7	6
	74	3	2	13	0
	69	8	3	8	0
	68	14	2	4	0
	63	7	7	14	6
	48	6	0	15	0
	42	14	4	6	6
Phœnix Mines	93	2	4	3	6
	92	8	4	6	6
	87	6	4	7	0
	86	6	6	13	0
	77	8	6	7	6
	50	7	8	2	6
	30	8	5	5	0
	25	14	4	6	0
	14	6	4	6	0
	10	2,6	6	10	6
Marke Valley	112	14	3	9	6
	100	9	4	1	6
	70	7	4	10	6
	68	7	4	4	0
	50	9	3	13	6
Wheal Crelake............	75	5,7	2	18	6
	74	5,7	4	7	6
	70	5,7	2	17	6
	57	3	7	7	0
	48	10	7	5	6
	46	7	4	17	0
Great Wheal Martha ...	120	2,6	2	15	0

Mines.	Tons.	Purchasers.	Price.		
Great Wheal Martha ...	75	2,6	1	12	0
	67	2,6	2	17	0
	54	2,6	4	15	0
	44	2,6,13	1	6	6
East Caradon..............	93	11	4	12	6
	75	11	3	17	6
	64	6	9	16	6
	63	3	7	10	0
	50	11	5	3	0
Wheal Edward...........	70	5,7	2	15	0
	68	10	3	17	6
	66	5,7	3	7	6
	38	10	2	11	0
	32	10	2	6	6
Bedford United............	109	5,7,8	4	4	6
	95	6	3	13	6
North Wheal Robert ...	92	14	2	6	6
	75	8	10	7	0
	37	14	5	18	6
Wheal Emma	82	9	2	16	6
	52	3	6	0	0
	26	5,7	2	8	6
Calstock Consols	70	5,7	3	18	0
	69	5,7	4	8	6
	20	5,7	1	7	6
Wheal Yarner......	113	2	2	13	0
	41	2	4	17	6
Sortridge Consols	68	8,10	10	5	0
	62	10	7	3	6
Wheal Friendship	68	5,7	8	16	6
	43	5,7	10	14	6
Wheal Arthur	59	5,7,8	3	5	0
	35	5,7	5	14	0
	16	8	2	15	0
Okel Tor.....................	70	3	3	0	6
	40	6	2	4	6
Brookwood	55	10	4	14	6
	7	10	6	6	6
Devon and Cornwall ...	50	6	2	5	6
Lady Bertha..................	32	6	1	13	0
Hawkmoor..................	30	5,7	4	9	6
Fursdon	29	6	6	2	0
Trehill........................	25	6	2	5	0
Nanjiles	10	4	6	12	0
Furze Park Ore	9	10	3	18	6

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.		
Devon Great Consols	2147	£9965	7	0
Phœnix Mines..................	564	3024	2	0
Marke Valley....................	400	1582	16	0
Crelake............................	370	1735	12	6
Great Wheal Martha.........	360	927	5	0
East Caradon....................	345	2079	11	0
Wheal Edward.................	274	850	1	0
Bedford United................	204	809	13	0
North Robert..................	204	1209	7	6
Wheal Emma....................	160	606	14	0
Calstock Consols.............	159	605	16	6
Wheal Yarner..................	154	499	6	6
Sortridge Consols............	130	£1141	17	0
Wheal Friendship............	111	1061	5	6
Wheal Arthur.................	110	435	5	0
Okel Tor..........................	110	300	15	0
Brookwood......................	62	304	3	0
Devon and Cornwall.........	50	113	15	0
Lady Bertha.....................	32	52	16	0
Hawkmoor........................	30	134	5	0
Fursdon...........................	29	176	18	0
Trehill..............................	25	56	5	0
Nanjiles............................	10	66	0	0
Furze Park Ore.................	9	35	6	6

EACH COMPANY'S PURCHASE.

	Tons.	Amount.		
1 Mines Royal	—	£ ——		
2 Vivian and Sons.............	419¾	1374	2	8
3 Freeman and Co.............	433	2222	12	6
4 Grenfell and Sons...........	10	66	0	0
5 Crown Copper Co...........	414	1829	3	9
6 Sims, Willyams & Co.......	1103¾	5312	16	11
7 Williams, Foster & Co....	924	5054	16	9
8 Mason and Elkington....	449	£2667	1	0
9 F. Bankart..................	332	1352	18	0
10 Copper Miners' Co........	627	3080	12	0
11 Charles Lambert..........	828	3249	19	3
12 Newton, Keates & Co....	—	——		
13 Alkali Co. (Limited)......	14¾	19	8	8
14 Sweetland and Co.........	484	1544	11	6
Total...........	6039	£27,774	3	0

Average Produce, 5¾.
Quantity of Fine Copper, 327 tons 5 cwts.

Average Standard, £135 13 0.
Average Price per ton, £4 11 6.

Copper Ores,

Sampled Dec. 11, and sold at Tabb's Hotel, Redruth, Dec. 26.

Mines.	Tons.	Purchasers.	Price. £	s.	d.
Great Wheal Busy	82	8	£2	9	0
	78	11	2	3	0
	66	8	2	0	6
	64	10	2	8	0
	62	6	2	9	0
	58	10	3	9	6
	56	8	3	2	0
	53	11	1	5	0
	46	14	2	2	0
	39	9	2	8	6
	36	9	3	1	0
Fowey Consols	100	2, 6	5	10	6
	98	2	5	13	0
	81	2, 6	6	12	6
	78	2	6	14	6
	63	2, 6	6	8	0
	60	6	3	1	6
South Caradon	105	8	6	1	0
	83	8	6	5	6
	81	7	9	8	0
	52	7, 8	9	1	0
	51	4, 6, 7	16	14	6
	39	2, 6, 7	17	9	6
	36	6	1	9	6
	23	4	6	10	6
Clifford Amalgamated (United Mines)	75	3, 7, 8	4	5	0
	74	3	2	12	0
	40	11	0	16	6
	37	14	0	17	6
	33	4, 7, 8	5	15	0
Clifford Amalgamated	25	4, 11, 14	£2	5	6
	20	3	0	5	6
	16	14	2	13	0
West Damsel	62	5, 7	4	13	6
	58	5, 7	4	7	6
	54	5, 7	5	1	6
	48	8	4	14	6
	42	9	3	14	6
	36	3	1	15	0
Tywarnhaile	47	4	4	5	0
	46	9	2	19	6
	45	14	2	0	6
	42	14	2	10	6
	40	8	2	10	6
	34	8	4	1	0
	16	4	3	17	0
South Crinnis	72	2	4	11	6
	68	3, 7	3	14	0
	32	3, 7	6	18	0
Craddock Moor	50	4	10	7	6
	42	4, 10	7	14	0
North Grambler	41	8	6	0	0
	39	8	7	17	6
Gonamena	29	11	6	6	0
	17	14	3	1	6
Grambler & St. Aubyn	33	7	7	18	6
Cuddra	30	9	3	14	6
Trenouth's Ore	30	6	1	13	6
East Tolgus	22	7	4	2	0
Creegbrawse	16	6	4	4	6

TOTAL PRODUCE AND VALUE.

	Tons.	Amount. £.	s.	d.
Great Wheal Busy	640	1,550	2	6
Fowey Consols	480	2,755	1	6
South Caradon	470	4,125	15	0
Clifford Amalgamated	320	871	1	0
West Damsel	300	1,263	18	0
Tywarnhaile	270	834	1	6
South Crinnis	172	801	16	0
Craddock Moor	92	842	3	0
North Grambler	80	553	2	6
Gonamena	46	234	19	6
Grambler and St. Aubyn	33	261	10	6
Cuddra	30	111	15	0
Trenouth's Ore	30	50	5	0
East Tolgus	22	90	4	0
Creegbrawse	16	67	12	0

EACH COMPANY'S PURCHASE.

	Tons.	Amount.		
2 Vivian and Sons	383	£2380	19	9
3 Freeman and Co.	205	603	7	0
4 Grenfell and Sons	193⅓	1458	8	2
5 Crown Copper Co.	87	408	16	6
6 Sims, Willyams & Co.	356	1765	0	3
7 Williams, Foster & Co.	365	2674	9	0
8 Mason and Elkington	656	3087	13	0
9 F. Bankart.	193	609	8	6
10 Copper Miners' Co.	143	517	16	0
11 Charles Lambert	208⅓	468	12	2
12 Newton, Keates & Co.	—	——		
13 Alkali Co	—	——		
14 Sweetland & Co.	211⅓	439	15	8
	3001	£14,413	7	0

Average Produce, 5¾
Quantity of Fine Copper, 171 tons 5 cwt.

Average Standard, £132 7 0.
Average Price per ton, £4 16 0

Copper Ores,

Sampled Nov. 20, and sold at Swansea, Dec. 10.

Mines.	Tons.	Produce.	Purchasers.	Price.
Cobre	96	12	7	£11 12 0
	93	12	6,7	11 11 0
	82	12¼	6	11 14 0
	8	14¾	6	14 4 0
	90	12⅜	3	11 17 6
	66	12¼	8	11 14 6
	58	19⅝	7	18 17 0
	7	64⅛	6	60 0 0
Knockmahon	93	13⅛	1	13 5 6
	59	10¾	6	10 14 0
	57	11¾	2	11 9 6
	71	10⅞	6,7	10 11 0
	70	10⅝	2	10 5 6
Berehaven	106	11¼	10	£11 2 6
	100	11⅝	1	11 2 6
	114	9¾	6	9 10 0
Ballycummisk	60	12⅛	7	12 7 6
	48	5	12	4 11 6
	16	4½	12	3 17 6
Laxey	112	5¼	7	4 19 0
West Kaime	16	5¾	6	5 6 0
Turkish	13	17	2	16 11 6
Connoree Precipitate	9	42	5	40 10 0
Cronebane	3	23	5	21 5 0
Tigrony	3	23	5	21 5 0

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.
Cobre	500	£6,616 13 0
Knockmahon	350	3,985 5 0
Berehaven	320	3,374 15 0
Ballycummisk	124	1,024 2 0
Laxey	112	554 8 0
West Kaime	16	£84 16 0
Turkish	13	215 9 6
Connorree Precipitate	9	364 10 0
Cronebane	3	63 15 0
Tigrony	3	63 15 0

EACH COMPANY'S PURCHASE.

	Tons.	Amount.
1 Copper Miners' Comp.	193	£2,347 1 6
2 Freeman and Co.	140	1,588 16 0
3 P. Grenfell and Sons	90	1,068 15 0
5 Sims, Willyams and Co.	15	402 0 0
6 Vivian and Sons	368	4,203 14 0
7 Williams, Foster & Co.	408	£4,415 8 0
8 Mines Royal Company	66	773 17 0
10 Mason and Elkington	106	1,179 5 0
12 C. Lambert	64	281 12 0
	1,450	£16,350 8 6

Copper Ores,

Sampled December 4th, and Sold at Swansea, December 24th.

Mines.	Tons.	Produce.	Purchasers.	Price.
Cobre	96	12¾	7	£11 12 0
	94	12¾	1,7	11 12 0
	93	13⅛	7	11 12 6
	92	13	3	11 12 0
	48	22⅛	1	20 16 0
	45	22⅝	1	20 7 0
	11	61⅛	5	57 8 0
	10	64⅛	5	59 7 0
	85	13¾	2	11 17 6
	90	13	6,7	11 19 0
Knockmahon	82	12⅛	2,6	£11 19 0
	59	13⅛	6	13 0 0
Berehaven	118	10⅛	6	9 19 0
Ookip	50	32⅛	1	31 5 0
	46	33	1	31 14 6
Lochwinnoch	49	5⅝	6	4 16 0
	27	4⅝	6	4 4 0
	5	9⅛	6	8 15 0
Australian Reg.	8	53	6	51 0 0
	1	53⅛	6	51 0 0

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.
Cobre	654	£9695 16 0
Knockmahon	141	1746 18 0
Berehaven	118	1174 2 0
Ookip	96	£3021 17 0
Lochwinnoch	81	392 7 0
Australian Regulus	9	459 0 0

EACH COMPANY'S PURCHASE.

	Tons.	Amount.
1 Copper Miners' Co.	236	£5482 8 0
2 Freeman and Co.	136	1618 1 6
3 P. Grenfell and Sons	92	1067 4 0
5 Sims, Willyams & Co.	21	£1224 10 0
6 Vivian and Sons	353	3820 3 0
7 Williams, Foster & Co.	281	3277 13 6
Total	1119	£16,490 0 0

Black Tin Sales.

Date.	Mines.	Tons	c.	q.	lbs.	Price per ton. £	s.	d.	Purchasers.	Amount of Money. £	s.	d.
Nov. 30.	St. Day United......	22	10	0	15	62	0	0	Trethellan	2392	18	11
	,, ...	16	1	3	4	62	0	0	Mellancar............			
	Great Wheal Busy	7	4	2	22	63	0	0	Carvedras............			
	,,	0	8	3	1	45	0	0	ditto			
Dec. 3.	,,	7	7	3	8	63	0	0	ditto	1039	12	1
	,,	0	16	2	1	60	10	0	ditto			
	,,	1	1	2	8	45	0	0	ditto			
,, 10.	Wendron Consols	13	2	3	13	—			Union	912	13	3
,, 13.	Penhale Moor	1	7	3	25	—			—	102	6	7
,, 14.	Great Work	9	4	1	24	76	5	0	—	703	5	4
,, ,,	Wheal Kitty	4	8	1	22	64	10	0	Treriffe	598	3	7
,, ,,	,,	4	18	0	20	63	15	0	Trethellan			
,, ,,	Penhalls	2	13	2	23	68	7	6	Trethellan	364	5	6
,, ,,	,,	2	13	0	0	68	10	0	Treriffe			
,, ,,	Great Wheal Vor ...	21	16	3	4	—			—	1612	5	0
,, 16.	Gt. Wheal Fortune	22	18	3	2	—			—	1726	10	6
,, 17.	Brea Consols	3	10	3	15	74	7	6	Mitchell & Co.......	342	9	7
	,,	1	7	0	24	—			ditto			
,, 19.	Tincroft	9	7	1	14	67	5	0	Bolitho & Sons ...			
,, 21.	,,	2	17	3	1	73	0	0	ditto	1533	17	0
,, 23.	,,	10	6	0	11	67	15	0	Harvey & Co.			
,, 21.	South Carn Brea ...	7	17	2	14	66	15	0	Carvedras..............	526	1	5
	W. Fowey Consols.	17	16	2	5	68	0	0	ditto	1212	5	0
,, 23.	Bottle Hill	2	17	3	20	68	15	0	Charlestown			
	,, ...	0	2	0	23	50	0	0	ditto	296	8	7
	,, ...	1	5	2	17	63	15	0	ditto			
	,, ...	0	1	2	4	50	0	0	ditto			

Tin ores being sold by private contract, the particulars are not generally published or accessible. We hope, however, to be able to provide monthly a tolerably complete list of the sales of this metallic ore: the above list gives no idea of the real sales.

Sundry Copper Ore Sales.

Sold at Liverpool, by Mr. J. P. Campbell, ex *Marion*, from Quebec.

Date.		Tons.	Price per ton. £	s.	d.	Purchasers.	Amount of Money. £	s.	d.
Nov. 28.	Lot 1.........................	84	14	12	6	Williams, Foster, & Co.			
	2.........................	84	14	11	0	ditto	4126	10	0
	3.........................	84	14	9	0	ditto			
	4.........................	22	21	0	0	Sims, Willyams, & Co....			
Dec. 17.	Parys	175	5	12	0	ditto	980	0	0

Sold at Liverpool, by James Hallows, ex *Ilymane*.

Date.		Tons.	Price per ton. £	s.	d.	Purchasers.	Amount of Money. £	s.	d.
,, 20.	Lot 2.........................	73	22	6	6	Williams, Foster & Co.			
	3.........................	73	22	0	0	Sweetland, Tuttle & Co.			
	4.........................	73	22	0	0	ditto			
	5.........................	70	22	5	0	ditto	9496	14	6
	6.........................	70	22	5	0	ditto			
	7.........................	70	22	0	0	ditto			

The Worthing Mining Company sold at the ore yard, Mellish's Wharf, Millwall, 20 tons of regulus, at £43 5s. per ton, and 20 tons of ditto, at £42 10s. per ton, realising together £1695.

Lead Ore Sales.

Dates.	Mines.	Tons.	Price per Ton £	s.	d.	Purchasers.	Amount of Money. £	s.	d.
Nov. 26.	Wheal Mary Ann	60	25	7	6	Stock & Co.			
	,,	13¼	10	0	0	ditto	1792	10	0
	,,	13¼	10	0	0	Pontifex & Wood			
,, 28.	Westminster	55	12	8	6	Walker, Parker and Co.	683	7	6
	Maesysafn	100	12	10	0	Newton, Keates and Co.	1250	0	0
	Mount Pleasant	40	12	15	0	A. Eyton	510	0	0
	Hendre Ucha	14	12	18	0	Walker, Parker and Co.	180	12	0
	Garreg	3	12	8	6	ditto	37	5	6
	Tyndrum	45	11	1	0	ditto	652	17	6
	,,	15	10	7	6	Newton, Keates and Co.			
	Lochtayside	1	50	10	0	ditto	50	10	0
	Pool Park	15	12	13	0	A. Eyton	189	15	0
,, 30.	Minera	100	12	15	0	Newton, Keates & Co.			
	,,	100	12	18	6	Walker, Parker & Co.			
	,,	100	12	18	6	ditto			
	,,	100	12	16	0	Newton, Keates & Co.	5885	0	0
	,,	25	12	13	0	ditto			
	,,	25	12	13	0	Panther Company			
	,,	10	11	5	0	Walker, Parker & Co.			
Dec. 2.	Newtownards	75	12	12	0	A. Courage and Co.	945	0	0
	East Logylas	70	12	4	0	Sims, Willyams and Co.	854	0	0
	Glogfach	60	16	1	0	ditto	963	0	0
	Cwmystwith	60	13	0	0	ditto	1542	0	0
	,,	60	12	14	0	ditto			
	Goginan	41	16	13	0	ditto	819	18	0
	,,	9	15	5	0	Walker, Parker & Co.			
Dec. 5.	Tassan	25	12	4	6	A. Eyton	305	12	6
,, 7.	Penpompren	20	13	14	0	Sims, Willyams and Co.	274	0	0
	Brynarian	20	12	5	0	ditto	245	0	0
,, 9.	Dylife	51	12	18	6	A. Eyton	659	3	6
,, 10.	Carmarthen United	25¼	13	3	0	ditto	335	6	6
,, 11.	Keswick	25	11	13	6	W. J. Cookson and Co.	291	17	6
,, 12.	Talargoch (Maesyrerwddu)	55¼	13	0	6	Walker, Parker & Co.	1340	5	9
	Talargoch (Coetia Llys)	49	12	12	0	ditto			
	Deep Level	25	11	15	6	ditto	294	7	6
	Brynford Hall	10	12	8	0	A. Eyton	124	0	0
	Herward United	14	11	7	6	Newton, Keates and Co.	159	5	0
	Speedwell	6	11	16	6	Walker, Parker and Co.	70	19	0
	Rhosesmor	60	12	15	0	A. Eyton	1525	10	0
	,,	60	12	13	6	Walker, Parker & Co.			
	Orsedd	15	12	8	6	ditto	186	7	6
	Tymaen	4	13	1	6	ditto	52	6	0
	Parry's Mine	30	12	11	6	ditto	377	5	0
	Bryn Gwiog	45	12	12	0	A. Eyton	567	0	0
	Long Rake	10	12	1	6	Walker, Parker and Co.	120	15	0
	Lady Eleanor	3	12	14	0	Newton, Keates and Co.	38	2	0
	Grosvenor	6	12	3	0	A. Eyton	72	18	0
	Roman Gravels	30	12	5	0	Newton, Keates and Co.	367	10	0
	Isle of Man Mining Co.'y.	100	22	10	0	ditto	2250	0	0
,, 16.	Frongoch	90	12	0	0	Panther Company	2173	10	0
	,, ,,	90	12	3	0	ditto			
	East Darren	77	15	0	0	ditto	1155	0	0
	Cwm Erfin	55	15	1	0	Sims, Willyams and Co.	827	15	0
,, 26.	Westminster	55	11	15	6	Newton, Keates & Co.	647	12	6
	Maesysafn	50	12	0	0	A. Eyton	600	0	0
	Mount Pleasant	50	12	6	6	Walker, Parker & Co.	684	7	6
	ditto	5	13	12	6	A. Eyton			
	Hendre Ucha	15	12	4	6	Walker, Parker & Co.	183	7	6
	Llangynog United	19	12	0	6	Newton, Keates & Co.	228	9	6
,, 27.	Clara United	20	11	15	0	Sims, Willyams & Co.	235	0	0

London Share-Market.

NOTWITHSTANDING the continued depression in trade generally, considering also the limited amount of business transacted in the metal trade, the Mining Market may be said to have gained, in the beginning of the month, a fair share of public attention, both in and out of the Stock Exchange.

The American difficulty still exercises a most unfavourable influence upon all our markets, and materially affects the operations of speculators and investors, which would otherwise naturally follow on the cheapness of money.

The absence of any very important discoveries necessarily adds to the prevailing dulness. The following are the chief mines which have been on the market:—South Caradon, Marke Valley, East Caradon, West Caradon, Devon Great Consols, Cook's Kitchen, Tincroft, Herodsfoot, South Frances, Wheal Seton, Providence, Margaret, Great Wheal Vor, West Seton, Clifford Amalgamated, Par Consols, East Basset, Wheal Mary Ann, North Downs, West Basset, Wheal Basset, Wheal Ludcott, Alfred Consols, West Par, Grambler and St. Aubyn, East Russell, Lady Bertha, Great Fortune, North Basset, Sortridge, Hingston Down, North Robert, West Polmear, North Treskerby, Wheal Arthur, Wheal Edward, East Grenville, Wheal Grenville, Wheal Moyle, Wheal Grylls, Wheal Uny, Wheal Unity, Great Retallack, East Carn Brea, Bryn Gwiog, Longrake, Tamar Consols, Rosewall Hill and Ransom, North Crofty, North Minera, West Rose Down, Wheal Union, Condurrow, Stray Park, Calvadnack, Wendron Consols, Billins, Drakewalls, Treloweth, Cargoll, Carn Camborne, Copper Hill, Wheal Norris, North Roskear, South Tolgus, and Wheal Agar.

South Caradon opened at 330 to 40, and a large number of shares changed hands at these prices. Subsequently, however, the quotations began to recede, owing to the fact that many of the holders were anxious to secure the advanced prices, and shares were rather forced upon the market. The mine is said to be in a very encouraging and prosperous condition. The latest closing quotations of these, as well as of other shares, will be given in a separate list at the end of this article, to which readers are referred. Marke Valleys continue to command a good enquiry, and are tolerably steady, and are more free from fluctuation than many other shares; the dealings have been generally between $9\frac{3}{4}$ and $10\frac{1}{4}$; the reserves of this mine are reported to be increased, and the coming dividend is expected to be 5*s.* per share as usual; the next meeting is due about the 9th proximo. East Caradon shares have been largely dealt in, and advanced to $28\frac{1}{2}$ "buyers," but again declined a little, owing in some degree to the last sale of ore realising a less amount than was expected; the next meeting will be held at Salisbury early in January, when a dividend of 15*s.* per share will in all probability be declared. West Caradon have also been in considerable request, and improved to 51-53, but became less firm on the report that the new lode at the 80, and the 38 fathom level on Menadue lode had fallen off a little; the mine has, however, good prospects at present.

Devon Great Consols, 365-75 shares, frequently inquired for, but no sellers are to be found; the mine is reported to be improved, more particularly in the eastern ends. Cook's Kitchen have been steadily absorbed for investment, and price remains very firm at 29-30. Tincrofts have advanced to 7¾-8, with a good amount of business, but shares scarce. Herodsfoot, many transactions have taken place at prices varying from 38-39, and shares have been taken off the market as they offered; they are very firm in character, and the mine reported to be looking better than at any former period. South Frances, after declining to 85-90, with scarcely any buyers, have again become in request, and advanced to 110-15; the mine has considerably improved, and the report now current, that the suit pending between the West Basset adventurers and South Frances is about to be withdrawn from the House of Lords and settled amicably, has materially assisted to again enhance the value of these shares. Wheal Seton very freely dealt in, and has been subject to great fluctuations from day to day, with a scarcity of stock at the settlement. The agent's reports from the mine continue of a very favourable character; the range of the quotations recently has been between 120 and 130.

Providence shares have declined to 37-39, and remain dull, without much business. Wheal Margarets also receded to 38-40: a large business has been transacted, and they close firm. Great Vors were much sought after and advanced, but have again declined to 6½-7. West Seton, shade firmer in character,—385-95. Clifford Amalgamated, after remaining dull and neglected for a long time, have become in request, and advanced from 29 to 33 and firm. Par Consols occasionally dealt in at 7-7¼. East Basset drooping and very flat, at 50-55. Wheal Mary Ann shares recently advanced, owing to the improved appearances and prospects of the mine: they are now quiet at 16-17. North Downs declined to 4⅞ "sellers," but as the time drew nigh for holding the quarterly meeting the price began to rally; they recovered, and advanced to 5-5¼. At the meeting a dividend of *5s.* per share was declared, leaving over £700 to the credit of next account, and the prospects of the mine justify the expectation of a similar dividend at the next meeting. West Basset rather firmer, 14-15; the mine is improved. Wheal Basset 85-90, but not many transactions. Wheal Ludcotts have been in fair demand, and not many shares offering, 2¼-½. Alfred Consols, nominally *10s.* to *20s.* West Par improved in the 65, and also in the winze below the 55; shares quoted at 3s. *6d.* to *5s.* Grambler and St. Aubyn advanced from 13 to 20, but have again receded to 17-19; the prospects of this mine have improved during the last few weeks, and although time may be required for the further development of this property, there still remain some chances of success.

East Russell has again resumed calls, having at the last meeting made a call of *3s.* per share; they close 3-½. Lady Bertha remain *13s.*-*15s.*, without much inquiry. Great Fortune tolerably steady, at 11¼-12¾; not very many transactions. North Bassets very dull, and neglected at 2½-3; a call of *3s.* per share was made at the last meeting. Sortridge Consols steady, *12s.*-*14s.* Hingston Downs have receded to 3½-3¾, and only a limited inquiry. North Robert steady,

but very little doing, 19*s.*-21*s.* West Polmear gradually declined to 5*s.*; the next lode is expected to be met with in about two months. North Treskerby very flat, with many sellers, and have receded to 18-20. Wheal Arthur in request, owing to the improvement in Wheal Edward; they close easier, 13*s.*-15*s.* in sympathy with its neighbour. Wheal Edwards rose to $3\frac{1}{4}$ "buyers," but the advance was not maintained; they close $2\frac{1}{2}$-$\frac{3}{4}$. Wheal Grenville, which had been dull at 28*s.*-30*s.*, came into request on receipt of news announcing an improvement at the 80-fm. level west, and advanced to 35*s.* "buyers," but again receded a little. East Grenville also firmer on the improvement in Wheal Grenville. Wheal Grylls largely dealt in at various prices; they close flatter at $13\frac{1}{2}$-$14\frac{1}{2}$.

Wheale Moyle steady at 2-$2\frac{1}{4}$; the mine is gradually getting into a better position. Wheal Uny, many transactions at $4\frac{3}{4}$-5; a call of 2*s.* per share was made at the last meeting; this mine is looking exceedingly promising, and bids fair to become a prosperous concern. East Carn Brea transactions have taken place daily to a large extent, but the price seems to keep about $9\frac{1}{2}$-10. There was no call required at the last meeting. It is now hoped that this mine will soon become remunerative to the shareholders.

Bryn Gwiog continue steady, at 26-28; they have a good course of ore in the shaft, where the sinking has been again resumed. Longrake have been dealt in between 13 and 15; the mine is reported to be much improved, both in the 48 east and in the winze.

Rosewall Hill and Ransom United, inquired for at 45*s.*-50*s.* North Crofty firm at 35*s.*-37*s.* 6*d.* North Minera; this mine is improved in the eastern shaft, 20*s.*-21*s.* West Rose Down very quiet, at 10-11; the next meeting will be due early in January, when a call will be required for current working costs. Wheal Union, 2-$2\frac{1}{4}$; not much inquiry. Condurrow reported to be looking well, but shares are very dull at $62\frac{1}{2}$-$7\frac{1}{2}$; the next meeting will be held some time in January.

Stray Parks occasionally in demand; price, 30-31. Calvadnack steady, at $7\frac{1}{4}$-$\frac{3}{4}$; scarcely any inquiries. Wendron Consols, 10-$\frac{1}{2}$. Billins progressing favourably; price quoted 18-20. Treloweth declined to 20*s.* "sellers," but are now rather firmer, 1-$1\frac{1}{4}$. Carn Camborne nominally quoted $\frac{7}{8}$-1. Copper Hill very flat, $97\frac{1}{2}$-$102\frac{1}{2}$. Wheal Norris frequently dealt in, $2\frac{1}{8}$-$\frac{3}{8}$. North Roskear, 21-2. South Tolgus inquired for, but shares very scarce, 46-48.

In Foreign Mines there has been a good legitimate business done, in which St. John Del Rey, United Mexican, Scottish Australian, Port Phillip, Great Northern Copper, Bon Accord and East Del Rey, have been dealt in to a considerable amount. St. John Del Rey has shown a great deal of fluctuation between 51 and 48; they are, however, now a little steady, at $48\frac{1}{2}$-$9\frac{1}{2}$. United Mexican have declined to $7\frac{1}{2}$-$\frac{3}{4}$. Port Phillips have remained tolerably steady, at $1\frac{1}{4}$-$\frac{3}{8}$. Scottish Australian have continued to advance, and are now quoted $1\frac{1}{4}$-$\frac{3}{8}$. Great Northern Copper, occasional transactions at $1\frac{3}{8}$ and $1\frac{1}{4}$, but this market has not been very active. East Del Rey quiet and steady, at $1\frac{1}{8}$-$\frac{3}{8}$. Dun Mountain continue to show firmness, 1-$\frac{1}{4}$. Cobre Copper quiet, at $35\frac{1}{2}$-$6\frac{1}{2}$. North Rhine have been dealt in at $\frac{3}{8}$. In Kapunda, Linares, Lusitanian, Mariquita, Worthing,

General and Fortuna, there have been scarcely any dealings. Bon Accord very inactive at ¼-⅜.

Monday, December 30th, 2 p.m.

Since the above was written an important improvement has taken place in East Caradon, where a new lode was cut on the 21st in the 60-fathom cross-cut, south, worth from £20 to £30 per fathom as far as seen. This important discovery established an immediate advance of 1 to 1½ per share; but after touching 29⅜ "buyers," they became weaker on the report of a falling off in the value of the 50 east to £80 per fathom, the 60 east being worth £50 per fathom. With such a course of ore as this mine has, no shareholder should be disheartened at these temporary fluctuations.

West Caradon has gradually receded to 47-8. Towards the end of the month, the price of Seton has become more settled at 122-24. Providence shares have also again improved to 39-40. Clifford Amalgamated have slightly receded to 30-32; at the next meeting the accounts are expected to show a credit balance of £2,500. At West Basset the next sale of ore will be 480 tons. In North Roskear a course of copper worth £20 per fathom has been met with in the 184 west.

In Foreign Mines, United Mexicans have again advanced to 8½-¾.

The following are the latest prices of British and Foreign Mines:—

BRITISH.

East Carn Brea, Wheal Grenville, Great Fortune and Cook's Kitchen in good demand, with several buyers. East Caradon, West Caradon and South Caradon rather flatter. East Basset dull. South Frances firm. The American news is not considered unfavourable, and the prevailing impression is that there will be no war. Alfred Consols ½ to 1, Calvadnack 6 to 8, Camborne Vean 1¾ to 2, Copper Hill 95 to 105, Cook's Kitchen 29¼ to 29¾, Devon Great Consols 360 to 370, East Devon 1¾ to 2, East Basset 50 to 52½, East Caradon 28¾ to 29, East Carn Brea 9¾ to 10, East Grenville 31/. to 33/., East Russell 3 to 3¼, Grambler and St. Aubyn 17 to 19, Great Wheal Fortune 12 to 13, Great Wheal Vor, 6½ to 7, Herodsfoot 38 to 39, Hingston Down 3½ to 3¾, Lady Bertha 11/. to 13/., Marke Valley 9¾ to 10, North Downs 4¾ to 5, North Robert 19/. to 21/., North Basset 2½ to 3, North Roskear 21 to 23, North Treskerby 18 to 20, North Minera 17/. to 19/., Providence Mines 40 to 41, South Phœnix 10/. to 15/., South Caradon 310 to 320, South Frances 115 to 125, South Tolgus 47 to 49, Stray Park 29 to 30, Tincroft 7¾ to 8, Treloweth 1⅛ to 1⅜, West Basset 14 to 15, West Caradon 44 to 46, West Rose Down 10 to 11, West Seton 275 to 285, Wheal Basset 80 to 90, Wheal Clifford Amalgamated 30 to 32, Wheal Cupid 29 to 31, Wheal Edward 2¼ to 2¾, Wheal Grenville 35/. to 37/6, Wheal Ludcott 2¼ to 2½, Wheal Margaret 40 to 41, Wheal Mary Ann 16 to 16½, Wheal Seton 121 to 123, Wheal Uny 4¾ to 5.

FOREIGN.

Dun Mountain pm. ⅜, Linares 7¼ to 7¾, Lusitanian 1½ to 2, General 23 to 24, Great Northern 1⅛ to 1¼, North Rhine 10/. to 11/., St. John del Rey 48 to 50, East ditto pm. ¼, United Mexican 8¼ to 8¾, Scottish Australian 1$\frac{5}{16}$ to 1$\frac{7}{16}$, Port Phillip 1⅛ to 1½, Bon Accord pm. $\frac{7}{16}$ to $\frac{9}{16}$, Kampunda 2 to 2½, Fortuna 1¾ to 2, Cobre 35 to 36.

Provincial Share Markets.

Dublin.—In the beginning of the month a steady demand was reported for dividend-paying shares, causing an improvement in Wicklow Copper shares of £2. 10*s*.; £53 to £55. 10*s*. being freely offered. Mining Company of Ireland shares suffered a reduction, but recovered, and were inquired for at £15. 5*s*. Speculative mines were not in favour. General Mining Company for Ireland shares neglected, although the chairman congratulated them "on the successful working of the machinery erected for the dressing of the Company's large deposit of calamine," and holds out hopes that the proprietors will soon have satisfactory results from the sale of metallic zinc and ochre. Connorree shares on sale at 31*s*. 6*d*., and business unimportant. Towards the middle of the month all affairs were disturbed by the American question, and mining shares of course participated in the general dulness. Wicklow Copper and Mining Company of Ireland shares were pretty steady, the former commanding £55 per share—buyers, and the latter being strongly in request at £15. 15*s*. General Mining Company for Ireland shares could be purchased at £5 each, but few were in the market. Connorree nothing doing. Later on in the month the death of the Prince Consort caused a general dulness, and mine securities suffered more neglect than any others, quotations being little better than nominal. Of the dividend mines the Wicklow Copper ranged from £53. 10*s*. to £54. 15*s*.—sellers. Mining Company of Ireland shares more steady, commanding £15. 7*s*. 6*d*. to £15. 10*s*. for cash or account. Of speculative mines the General Mining Company for Ireland were most in favour, though they dropped to £5. 5*s*., with signs of weakness. Connorree shares offered at 30*s*. to 31*s*. for long-deferred settlement. Towards the end of the month, although broken for business, transactions in mine shares were animated. Wicklow Copper and Mining Company of Ireland shares largely dealt in; the former, however, leaving off at 54, or a decline of about 10*s*. per share—sellers, while the latter experienced a rise of nearly $\frac{3}{8}$, and are inquired for at $15\frac{3}{4}$. General Mining Company for Ireland shares were in request at $5\frac{3}{8}$, but are now readily obtained at a slight reduction. Connorree shares have fluctuated between 30*s*. 6*d*., 31*s*., 31*s*. 6*d*., and remain on sale at 32*s*. Carysfort shares have continued unsaleable during the month, no transaction being reported.

Miscellaneous.

A very valuable paper has been read at the Scottish Society of Arts, Edinburgh, by Mr. Ralph Moore, mining engineer, Glasgow, "On the Black Band Iron-stones of Edinburgh and the East Lothian Coal Field." The following description of this famous mineral may be interesting: "They (the Coal Measures) contain both clay-band and black-band iron stones. Clay iron stones contain from 30 to 50 per cent. of metallic iron. Before being smelted they are mixed with coal, and calcined in kilns, or large heaps, to drive off the carbonic acid gas, sulphur, and other impurities. This description of iron stone is found in seams or bands, and in nodules, throughout the whole of the measures; but is most plentiful in the lower part of the section. Black-band iron stone is a carbonate of iron, laminated with coal, generally in sufficient quantity for calcination without further admixture of coal, and leaves, when calcined, a metallic coke, containing from 50 to 70 per cent. of metallic iron. This description of ironstone is found in seams or bands, in well-defined positions in the measures;

but they are neither persistent in positions nor equable in quality. Sometimes the seam is wanting altogether, or so thin as to be unworkable; at other times the coaly element so predominates that its metallic value is of small amount; while not unfrequently it contains nothing but coal. A good black-band iron stone contains from 2 to 8 per cent of coal. When it contains more than 20 per cent. of coal it is of little value, unless mixed with clay bands, which use up the excess of coal. It is more easily smelted than clay band, requires less coal; and the weekly produce of a furnace on black band is 50 per cent. greater than from clay band."

Mr. Moore's sketch of the future of the make of iron in Scotland, from this mineral, is most interesting in a commercial point of view, and forms a valuable contribution to our knowledge.

At the meeting of the Geological Society of Manchester, on the 26th November last (Mr. Dickinson, inspector of mines, president, in the chair,) the first portion of a paper "On the Ventilation of Mines," was read by Mr. Joseph Goodwin. The paper was followed by rather a lively discussion, Mr. Chorlton and Mr. Fletcher deeming that it cast imputations on colliery managers. Mr. Goodwin considered that the furnace possessed an advantage over all other methods of producing ventilating currents, and that the objections raised against mechanical means of ventilation had proved too well grounded. Mr. Dickinson, without committing himself to any distinct opinion, and admitting the advantage of the old furnace for deep pits, took a more favourable view of the value of mechanical ventilation: he mentioned that he and his colleague, Mr. Atkinson, were engaged in a series of experiments on the ventilating appliances of this country, and also of Belgium, so as to ascertain the real value of the various motive powers. Mr. Chorlton referred to a ventilating fan at Earl Fitzwilliam's colliery at Elsecar, which, when perfected, would entirely supersede the furnace.

Mr. William Henderson, whose connection with the successful operations at Alderley Edge, Cheshire, had made him known to the public, proposes establishing extensive copper reducing works at Glasgow. Mr. Henderson, who is said to be connected with some well-known capitalists in London—among whom the name of a banker is mentioned—intends principally to deal with the burnt mundics remaining from the sulphuric acid works, of which Messrs. Tennant alone could probably supply from 500 to 1,000 tons per month. As this has now to be sent for sale to Swansea, where it is used chiefly as a flux, Mr. Henderson is very sanguine as to the great profits to be realized by treating it on the spot by the processes which he has patented. It is said that the site for the works is already acquired.

Under the heading "How would the war with America affect the coal trade," the *Colliery Guardian* has the following observations:—"A war with America would materially interfere with some branches of the coal trade, either by quickening the demand or by cutting it off altogether. Orders would be plentiful for good steam coal for shipping purposes, and thus a stimulus would be given to the trade both in South Wales and in the North-Eastern district; but on the other hand, the shipping trade of Liverpool in coal would be to a considerable extent extinguished, for much of the coal sent from that port goes to the United States. A great quantity of cannel is shipped from Liverpool to New York and other American ports, and of course these shipments would be completely stopped in the event of

a war. On the whole, however, the coal trade would suffer less from an American war than any of the other great branches of national industry, for the principal part of what we raise is for home consumption, while of our shipments the whole of North America does not take more than one-twentieth part. The loss of the American trading in coal and cannel will be severely felt by some of the large colliery owners of South Lancashire, and thus the calamity will fall upon that district which already suffers most severely from the war in America; but taking the trade generally, the decreased demand from our friends across the Atlantic will be more than compensated by the additional demand from our own Government."

Mr. Alexander Macrae, oil and produce broker, of Liverpool, in a circular dated 16th December, says:—

"The introduction of petroleum, kerosine, photogene, or rock and well oil, is making tremendous strides, though it does not surpass the prediction in my first circular, namely, that it would be second only in extent to cotton. I will even go a step further, and venture to assert that if the rocks and wells of Pennsylvania, Canada, and other districts, continue their exudation at the present rate of supply, the value of the trade in this oil may even equal American cotton. Montreal (internally, and likely externally by this time) is lit with the white refined, and I can see no reason why London and Liverpool should not also be, for the oil gas distilled trom the raw petroleum is immensely superior and much more brilliant than our own coal gas. For years we have sent coals to America for gas-works, and it will be a singular freak of events if she and Canada should now supply us with a better expedient. Invested interests will perhaps stay it for the moment, but will they ultimately?

"The refined for burning (known in this country as paraffin oil, and of which about 500 tuns a week are sold), has been selling at £30 to £40 per tun (of 252 gallons) for yellow to white, while the crude varies in value from £6 to £25, according to test. The merits of the petroleum will be better understood when importers are informed that besides the uses already named, lubricating oils of every colour and specific gravity can be obtained from it; wax also for the manufacture of paraffin candles, naphtha, and consequently benzole (from which the fashionable dyes, magenta, rosenine, anneline, &c., are obtained), pitch, &c. &c., all of them having several other applications. It is reported on the very best authority that they have discovered from it now an available substitute for spirits of turpentine for paints, and also a solvent for india-rubber; results, I understand, that they have not effected in America or Canada, and the importance of which cannot be overestimated.

"In my first circular it was stated that some 7,000 barrels of crude and refined were on the way to this country, and the *Times* of the 13th instant mentions 8,000 barrels on the way to London. There are 10,000 barrels coming to Liverpool, and 2,000 barrels to Glasgow, in all about 20,000 barrels, (or £100,000 sterling, and the trade not six months old), a simple tithe of what we want! American hostilities and the ice in the St. Lawrence (although we have still St. John's, New Brunswick) may stop supplies to some extent, but I have no doubt the future will vindicate the expectations I have so frequently expressed.

THE

MINING AND SMELTING MAGAZINE.

FEBRUARY, 1862.

Notes on the Gold Deposits of Nova Scotia.

By J. Arthur Phillips.

The whole of the Atlantic shore of the province of Nova Scotia is bordered, in an unbroken line, by strata of a metamorphic character and probably great geological antiquity, frequently broken through by eruptive rocks. These form a coast in some places low and rugged, and in others boldly undulating; their soil being generally rocky and sterile, although there are large tracts well covered with timber, and affording prosperous agricultural settlements. Along the Atlantic shore this district is generally low, gradually rising to the height of some three hundred feet at its northern extremity. Its southern or coast line has, according to Dawson, a general direction of south 68 deg. west, whilst its inland side, although presenting some considerable undulations, has a general direction of south 80 deg. west. The extreme breadth of this band at Cape Canseau, its north-eastern extremity, is about eight miles, whilst in its extension westward it gradually increases, until at the head of the west branch of the St. Mary's River, eighty miles west of Cape Canseau, it is about thirty miles wide. In the western counties its breadth is known to increase still further, and although its northern boundary has not as yet been accurately ascertained, its total width cannot be far short of fifty miles. Its length corresponds with that of the peninsula of Nova Scotia.

This band, in which the whole of the gold hitherto discovered has been found, chiefly consists of thick bands of slate and quartzite, highly inclined and having a general north-east and south-west strike. In different localities these rocks, which probably belong to the lower silurian epoch, have been penetrated by masses of granite, and in their vicinity the quartzites and clay-slates are usually altered into gneiss and mica-slate, or other rocks presenting a more than ordinarily metamorphosed appearance. Since the gold discoveries in California and Australia have become generally known, and public attention has been directed to the circumstances under which au-

riferous deposits usually occur, reports of similar discoveries have from time to time locally arisen in different parts of Nova Scotia. In every instance, however, either iron pyrites or bright golden scales of mica, occurring with more or less highly coloured sands in the beds of various mountain rivulets, would appear to have been mistaken for the precious metal. Some years since, also, an article on the subject of gold mining appeared in *Blackwood's Magazine*, in which it was affirmed that gold would be found in the hills to the south of Annapolis, and comparisons were instituted between this locality and the valley of the Sacramento.

At the time of its appearance, this article produced much excitement in the colony, and rumours of actual discoveries of gold found their way into the local papers. Many persons were thus induced to leave their ordinary employments in order to seek for gold; but their search having in all cases proved unsuccessful, the excitement gradually subsided, and the subject was ultimately forgotten.

It is also worthy of remark, that Dr. Dawson, when describing, so long ago as 1855, the great metamorphic band on the Atlantic shore of Nova Scotia, observes—" Quartz veins, however, occur abundantly in some parts of this district, and it would not be wonderful if some of them should be found to be auriferous."

There is, nevertheless, no authentic evidence of the discovery of the precious metal in this province previous to 1860, when some hundreds of persons, tempted by rumours of the existence of gold, commenced exploring in the woods near the head waters of the Tangier, about ten miles from the sea coast, and proved the presence of this metal in small quantities. The amount of gold obtained was, however, so small, and the distance from roads and navigation so considerable, that the miners became discouraged and the excitement quickly subsided.

In the month of March last year, a man who was stooping to drink at a brook observed a small piece of gold among the pebbles at the bottom, and having picked it up searched and found other specimens. This took place about a mile to the eastward of the mouth of Tangier river, a locality most favourable for the prosecution of mining operations, and within half a mile of a safe harbour.

From this date attention became directed to the locality, and numerous claims were taken up and worked by the people of the neighbourhood, who obtained considerable amounts of gold by breaking the quartz rock with hammers and washing the resulting sand in tin pans. The success attending these rude operations being considerable, population immediately rushed in ; a large area of claims was taken up, and sundry arrastras and Chilian mills were erected.

In June the discovery of gold was reported in the county of Lunenberg, at a locality called the "Ovens," on a peninsula which forms the western boundary of Lunenberg harbour, and at a distance of about five miles from the town of that name.

The veins of auriferous quartz in this place, although small, are frequently very productive, and appear to cross each other in almost all directions, in a metamorphic shale belonging to the great southern band. On these discoveries being made public numerous claims were immediately taken up, and various local companies formed, with a

view of working the veins presenting themselves numerously in the cliff.

While attention was thus generally directed to quartz mining, Mr. Campbell, an amateur geologist of the province, tried the experiment of washing the sands accumulated on the sea shore, and having been successful beyond his expectations, there was a general rush from the upland mining to claims situated at the foot of the cliff; numerous claims were quickly staked off, and worked by means of cradles and tin pans, so that the aggregate daily yield of the several shore operations shortly reached one hundred ounces.

Shortly after public attention had thus been attracted to Lunenberg, auriferous quartz was also found at Dartmouth, Lawrencetown, and Sheet Harbour, and these discoveries were rapidly followed by others at Wine Harbour, Isaac's Harbour, and Sherbrooke, as well as at Laidlaw's Farm, on the western side of Lake Thomas, where magnificent specimens were obtained from a tortuous bed of quartz, lying at a depth of about four feet from the surface, and also from various loose boulders found on the surface of the soil.

More recently gold has been discovered at Little Chester, on the South or Horton Mountain, and reports almost daily reach Halifax of gold having been found in greater or less quantities at various localities situated in different parts of the great southern band of metamorphic shales before described.

In addition to the metamorphic rocks on the Atlantic shore of Nova Scotia, there is another belt in the northern part of the province, much resembling the great coast band, but probably belonging to a more recent formation. This district is mainly composed of talcose and chloritic shales, occasionally penetrated by green-stone, syenite, and granite; and as numerous quartz veins, containing iron pyrites, have been discovered in these rocks, it is more than probable that gold may ultimately be found in them.

It would be impossible to form any reliable estimate of the total amount of gold obtained in Nova Scotia since its first discovery in the province, as the claims are for the most part worked by private individuals, who are, generally speaking, indisposed to furnish information relative either to their success or failure.

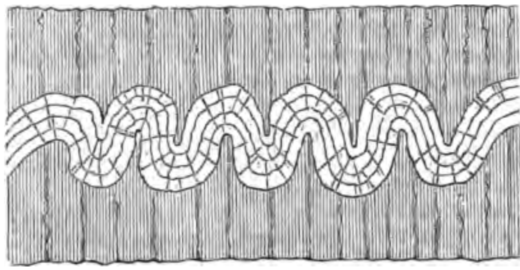
The most remarkable deposit of auriferous quartz hitherto discovered in Nova Scotia is undoubtedly that found at Laidlaw's Farm.

The claims in which the largest amount of gold-bearing quartz has been discovered are near the summit of a hill composed of hard metamorphic shales, and openings have in several places been made to the depth of some four or five feet, upon a corrugated band of quartz of from eight to ten inches in thickness. This deposit of auriferous quartz is entirely different from anything I have before seen, and when opened upon presents the appearance of trees or logs of wood, laid side by side, after the manner of an American corduroy road.

From this circumstance the miners have applied the name of barrel quartz to this formation, as in some cases it presents an appearance not unlike a series of small casks, laid together side by side and end to end.

The following sketch may, perhaps, explain better than words the mode of occurrence of this deposit:—

The rock covering this peculiar horizontal vein is exceedingly hard, but beneath it, for some little distance, the shale is softer, and somewhat more fissile than above. The quartz is itself foliated parallel to the lines of curvature, and when broken exhibits a tendency to break in accordance with these striæ. These headings, and particularly the upper surfaces of the corrugations, are generally covered by a thin bark-like coating of brown oxide of iron, which is frequently seen to enclose particles of coarse gold, and the quartz in the immediate neighbourhood of these ferruginous bands is itself sometimes highly auriferous.



It is also worthy of remark, that the headings occurring between the foliations of the quartz do not so frequently as the exterior coating of the upper surface of the deposit contain visible gold.

The permanent value of such a deposit will evidently depend not only on the richness of the quartz found, but will also be much affected by the amount of auriferous rock to be obtained; and it is, therefore, of much importance to ascertain the superficial extent of the bed, and if others may not exist beneath it. It would likewise be desirable to determine whether, at some point in its course, it may not assume an inclined position and present the appearances of an ordinary quartz vein.

The other gold veins of the province present, generally speaking, few distinctive peculiarities, and very closely resemble those found in California and Australia. Their general course is about north 60° west, and their dip towards the south; but there are not unfrequently exceptions to this rule. In addition to gold, the auriferous veins of Nova Scotia contain considerable quantities of iron pyrites, mispickel, galena, blende, and less frequently small quantities of argentiferous sulphide of copper. Here, as elsewhere, the presence of metallic sulphides is considered a good indication of a vein being auriferous, and veins containing disseminated galena are almost invariably found to contain a remunerative quantity of gold.

The productive gold veins hitherto discovered have, as before stated, all been found in the older rocks on the Atlantic shore, and commonly occur in parallel groups, through the centre of which, and parallel to the productive veins, on either side of it, a large reef of crystallized and comparatively non-auriferous quartz is in many instances found to run.

These large courses of quartz, or "bull veins," as they are locally called, usually contain traces of the precious metal, but not in sufficient quantity to pay the expenses of working by the appliances now in use, and the attention of the miner is therefore exclusively directed to the smaller but richer lateral veins which often afford quartz yielding from five to fourteen ounces of gold per ton.

The only crushing and amalgamating appliances in the colony consist of a few arrastras and Chilian mills, each capable of crushing about a ton of auriferous quartz per diem.

The attention of the local miners has been almost entirely directed to the exploration of the numerous quartz veins, and placer diggings have been consequently all but entirely neglected; it is, however, probable that a careful examination of the alluvial deposits in the vicinity of some of the principal rivers would result in the discovery of rich deposits of placer gold.

An analysis of the Tangier gold, specific gravity 18·95, gave,*

Gold	98·13
Silver	1·76
Copper	0·05
Iron	trace.
	99·94

An analysis of Lunenberg gold, specific gravity 18·37, gave,

Gold	92·04
Silver	7·76
Copper	0·11
Iron	trace.
	99·91

The Tangier specimen was taken from a quartz vein, and is remarkable for its purity. The Lunenberg gold was in small particles washed from the sands on the sea shore.

A geological survey of the province of Novia Scotia is much required, and would probably lead to the discovery of other useful minerals in addition to those already worked. The districts in which gold has been discovered, and in which it will probably be found, have been as yet only casually examined; but the great extent of metamorphic strata in the province, and the success that has attended the explorations hiterto made, indicate that a new and important source of mineral wealth will ere long be added to this already flourishing colony.

The Lancashire and Cheshire Coal-fields.

By Edward Hull, B.A., F.G.S.,
Of the Geological Survey of Great Britain.

If we observe the distribution of our centres of manufacturing industry, whether it be those of the harder or softer fabrics, we cannot but be struck by the fact, that it depends essentially on the mineral resources, rather than on physical or topographical advantages. The iron-works of South Wales and Staffordshire, of Low Moor and

* Analysis by O. C. Marsh, of Yale College.

Cleveland in Yorkshire, and of Lanarkshire in Scotland, are examples of the one kind; the cotton mills of Lancashire, and the cloth and silk factories of Derbyshire and Yorkshire, are examples of the other. That mineral resources will ultimately prevail in localizing a special branch of industry, and are a more powerful influence for this purpose than any that may be derived from relative position, climate, elevation or any similar circumstance, is also illustrated by the migration of the West-of-England woollen manufacturers to the north, and by the establishment of smelting furnaces at Swansea, at a considerable distance from Cornish mines whence the ores are principally derived. The county of Lancaster exemplifies this principle in numerous instances. We find the cotton factories concentrated over, and around the coal-bearing area, while at Liverpool—the port at which the raw cotton is landed, but which is situated about ten or twelve miles beyond the boundaries of the coal-field—not one factory has been erected.

From all this we see that the position and extent of our *foci* of industry are essentially dependent upon the supply of mineral fuel, and that the force generated by its combustion is the very life of that complicated and varied mechanism which ministers to our wants and our prosperity as a nation.

Regarding the city of Manchester as the heart of the cotton trade, a few observations to illustrate its peculiar fitness in a physical point of view for assuming this position may not be without interest. The city (including Salford) stands on the New Red Sandstone, a most excellent foundation, whether, from its firmness and porousness, as a site for building, or as a source of water-supply. In this respect Manchester resembles Liverpool, Chester, Birmingham, Notts, and many other large towns.* In the next place, the city stands at or near the confluence of several rivers of considerable size—the largest being the Irwell, which is about the breadth of the Thames at Oxford. The other streams are the Irk and the Medlock. It is scarcely necessary to say that water is essential to the working of the mills and bleach-works, but long before reaching Manchester these streams have degenerated into noxious sewers, so that the mills depend either on wells, or supply from the water-works. The third point is the proximity to the port of Liverpool through which the factories are fed with cotton. Until the introduction of railways, this material was conveyed by barges along the Bridgewater canal and the river Irwell, but is now brought by all these modes of conveyance. The fourth and last advantage, and that without which all the others would have proved unavailing, is proximity to the Great Lancashire coal-field, which stretches to the west, the north, and the east of the city, into which the mineral is being constantly poured by roads, railways and canals, all converging towards this centre of consumption, from the districts of Wigan, Worsley, Pendleton, Clifton, Middleton, Oldham, and Dukinfield.

* In the case of Manchester, a great portion of the buildings are deprived of the benefits arising from the foundation of new red sandstone, as over this formation there is generally a considerable thickness of boulder clay. As a source of water supply, however, it is highly appreciated—many of the factories and bleach-works being supplied from wells sunk through the "red rocks."

The Lancashire coal-field* stretches in a crescent shape from Huyton near Liverpool to Ashton-under-Lyne, where, upon crossing the river Tame, it enters Cheshire and stretches southward towards Macclesfield. In its range it embraces the important towns of Prescot, St Helen's, Wigan, Bolton, Radcliffe, Bury, Heywood, Rochdale, Middleton, Oldham, Ashton-under-Lyne, and Staleybridge. Its extreme length from west to east is about 32¼ miles, and its average breadth 6 miles. Its area is 192 square miles, or including the Manchester coal-field, which is isolated from the main area, 197 square miles; and it contains, according to my calculation, about 3,700 millions of tons of coal to a depth of 4,000 feet from the surface.†

The coal measures are divisible into three well-defined stages, as follows:—

The Upper.—Represented most completely at the east side of Manchester, containing several beds of limestone; 8 seams of coal, of which 4 are workable; a bed of calcareous hæmatite, which is now being worked at Patricroft. Thickness of the series 700 yards.

The Middle.—Containing all the thick coal seams. Of these there are 18 workable in the Huyton and Halsnead district, 17 in the St. Helen's district, 17 in the Wigan district, 16 in the Worsley and Clifton district, 12 in the Radcliffe district, 10 in the Oldham, Ashton and Dukinfield district, and less than half the number in the district of Poynton, where the series is incomplete. Thickness 1,000 yards.

The Lower.—Containing several thin coals, of which the most important is the Gannister seam, from 2 to 2½ feet in thickness. This seam is worked amongst the hills east and north of Staleybridge, Oldham, Rochdale, Bury and Bolton. But at Chorley a higher, and at Up-Holland and Billinge a lower seam is the principal coal belonging to this series. Thickness 600 to 700 yards.

At the base of all the above measures lies the "Rough-rock" or Uppermost Millstone, under which there are two or three lower seams of coal, seldom sufficiently thick for working.

We shall now give a few particulars regarding the principal coal-seams of each district; premising, however, that there are in these districts other seams of value, which space will not allow of description. Commencing with ST. HELEN'S:—

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* This coal-field has been partially described by several authors. The earliest notice partaking of a geological description is that of Mr. Elias Hall, who produced a map showing the range of the different coal-seams; it is, however, extremely inaccurate, though great allowance must be made on account of the state of our knowledge at the period in which it was published. In 1837, Mr. James Heywood, F.R.S., &c., published in the pages of the Trans. of the Liter. and Philos. Society of Manchester a short but valuable description, accompanied by a coloured geological map, in which the boundaries of the coal-field, and some of the outcrops of the coal-seams and faults, are laid down with accuracy along the southern margin. From 1839 up to the present time, Mr. E. W. Binney, F.R.S., has contributed a series of valuable papers, published in the pages of the Transactions of the Geological and Philosophical Societies, which have rendered the structure of this district as well known as that of any other coal-field in England. The most recent publications are the maps of the Geological Survey, now in progress, and several memoirs by the author on the districts of Prescot and Wigan, 1860. We should add, that Mr. John Hall and Mr. F. Looney have done much in the elucidation of the structure of this part of Lancashire.

† "The Coal-fields of Great Britain." 2nd Edit., p. 130.

The three best seams are the *St. Helen's Main Delf,** the *Ravenhead Higher and Main Delf,* and the *Rushy Park Delf.* The St. Helen's Main Delf has been reached at a depth of 500 yards; its average thickness is 9 feet; it rests on a floor of black bass, and has a roof of sandstone 23 yards in thickness. A few feet underneath is a seam of cannel, about 2 feet thick, which has only been worked to a very limited extent, though stated to be of good quality.

The *Ravenhead Main* Coal lies 122 yards below the St. Helen's Main Coal; its thickness is 7 feet, with a roof and floor of clay, locally called "Warrant." † This forms a very bad support, and necessitates a portion of the seam being left.

Rushy Park, or *Orrell 5-feet Coal.* At a depth of 254 yards below the last is the *Rushy Park Mine*—a most valuable seam over the western and southern part of the coal field, but one which becomes deteriorated both in thickness and quality from Wigan, eastwards; its thickness in the neighbourhood of St. Helen's and Prescot is from 4 to 5 feet, with a roof either of shale or sandstone. West of Wigan it becomes the celebrated Orrell 5-feet seam, long esteemed in the market, but now exhausted over a large extent of country. At Wigan it becomes the *Smith Coal,* and in the direction of Bolton and Clifton the *Three-quarters Mine,* its thickness having diminished to 27 inches.

A remarkable change supervenes in the case of the *St. Helen's Main Delf,* and two underlying seams when traced eastwards to the Haydock Collieries, near Ashton, in Makerfield, where they become the *Florida Mines,* and northward to Wigan, where they become the *Pemberton Mines.* These changes will be best understood by reference to the following table:—‡

REPRESENTATIVE SERIES OF COALS, &c.

St. Helen's.	Ft.	In.	Haydock.	Ft.	In.	Wigan.	Ft.	In.
St. Helen's Main Coal	9	0	*Higher Florida Coal*...	4	6	*Pemberton 5-feet Coal*...	5	0
Strata	9	0	Strata, with a band of black bass representing the Cannel of St. Helen's ...	24	0	Strata	30	0
Cannel...	2	3				*Coal* (good quality)	2	6
Strata	18	2				Strata	45	0
Four Feet Coal ...	4	0	*Lower Florida Coal,* with a parting of clay 2 ft. 9 in.... ...	10	9	*Pemberton 4-feet*..	4	6
Strata	46	2	Strata	36	10	Strata without any workable coal seam	445	0
Roger Coal	2	0	*Stoney Roger Coal*	3	4			
Strata	7	4	Strata	126	0			
Pigeon-house Coal.	2	0	*Pigeon-house Coal*	3	0			

* The term "Delf" is generally applied to a coal-seam in the west part of Lancashire. At Wigan, Bolton, and eastward, the term "Mine" is used in the same sense.

† "Warrant," or "Warren Earth" is the term usually employed to designate the clay-floor or under-clay of a coal-seam.

‡ "Geology of the Country around Wigan," p. 17.

Wigan District.—The principal seams in this district are in descending order; the *Ince Yard 4 feet and 7 feet*, the *Pemberton 5 feet and 4 feet*, the *Cannel*, the *Haigh Yard*, and the *Arley Mine* or *Orrell 4-feet Coal*.

The *Ince Mines* are of fair quality, though rather soft, and their value seems to vary inversely as their thickness. As these seams are generally very shallow, they have already been exhausted over the greater extent of their area.

Of the two *Pemberton Mines* the *4-feet seam* is superior to the *5-feet seam*, and is justly held in high estimation. It has generally a good roof, and has been largely worked at Standish, Pemberton and Ince.

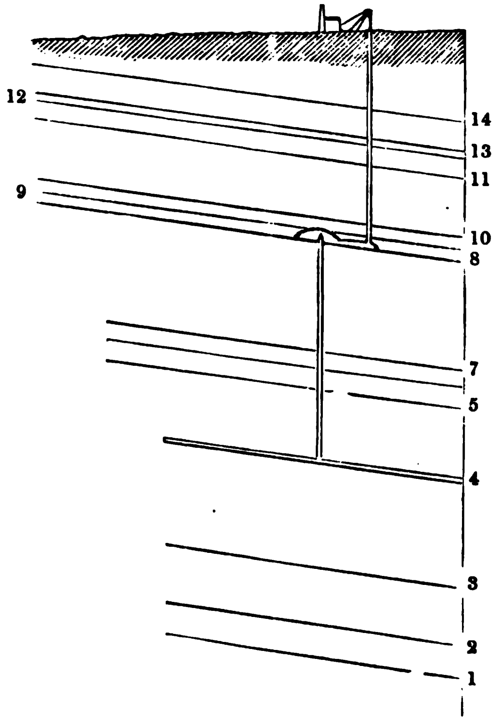
The Cannel.—This celebrated mineral is mentioned by Camden* as having been obtained early in the 17th century from Haigh, near Wigan. Along the rising grounds of Haigh Hall, to the north-east of the town, this seam crops out, and has been extensively wrought from "day-eyes" or adits driven into the side of the hill. It is remarkable that the Cannel Mine attains at Wigan its greatest thickness of 3 feet, from which, as a centre, it thins away in every direction, or else passes into common coal. As seen in the galleries of the Rose Bridge or Ince Hall Collieries, or in solid blocks, this mineral has all the appearance of black marble, and is capable of receiving a high polish. It is almost exclusively employed for gas, and it fetches at the pit mouth nearly double the price of ordinary coal. It is almost unnecessary to state that the extraction of a seam of such value has been very rapid, and that it is already exhausted over a very large tract of country; in fact, we shall probably not be in error in stating that this is the case within a vertical depth of 300 yards. The district of Wigan is, however, peculiarly constructed. It is traversed by a series of parallel faults, varying N.N.W. and S.S.E., described by the late Mr. Peace,† and is thus parcelled into several "belts," of which one series are *up-casts*, the others *down-casts*. Several of the largest collieries—as those of Ince Hall, Kirkless Hall, and Haigh—are situated on the up-cast or "shallow belts," and over these the Cannel, as well as other adjoining seams, have already been very largely extracted. In the deep belts, however, there still remains an almost unbroached reservoir of several of the most valuable seams, including the *Cannel*, the *King*, the *Yard*, and the *Arley* Mines. In one of these belts, which ranges by the west side of Wigan, the Cannel has lately been reached at a depth of 600 yards by the Ince Hall Company; and in another deep belt at Rose Bridge Colliery, near Ince, the same mine has been wrought since June, 1858, at an equal depth of 600 yards, through a shaft with a "double lift," being at that time the greatest depth attained in Britain. (See fig. 1.) The roof of this seam is composed of strong black shale, very tenacious, and celebrated for the specimens of fish-remains it has yielded.

* Britannica, Vol. iii., p. 300.

† British Association Reports.

FIG. 1.

SECTION AT ROSE BRIDGE COLLIERY, TO SHOW THE SUCCESSION OF COAL MEASURES AT WIGAN.



The Colliery at Rose Bridge is worked by a double lift. The first shaft was sunk 298 yards to the Pemberton Four-feet Mine (8) in 1854. This coal was worked for some time, when it was determined to sink a new shaft (No. 2) from the Four-feet Seam down to the Cannel and King Coals (4). This was commenced in September, 1857, and reached the King Coal in June, 1858, at a depth of 300 yards; the total depth of the two shafts from the surface being about 600 yards. The second shaft is worked by independent engines and lifting gear erected in an excavation or chamber in the strata above the Pemberton Four-Feet Coal. This plan of a double lift has the advantage of greater security, but entails a loss of time and increase in expense of getting the coal.

The coal-seams shewn in this diagram are: 1. Arley Mine. 2. Orrell 5 feet or Smith Coal. 3. Yard Mine. 4. Cannel and King Coals. 5. Wigan 9 feet. 6. Wigan 4 feet. 7. Wigan 5 feet. 8. Pemberton 4 feet. 9. 2 feet. 10. Pemberton 5 feet. 11. Furnace Mine. 12. Ince 7 feet. 13. 4 feet. 14. Yard Mine.

The *Haigh Yard* coal is of excellent quality, and produces a good coke; its thickness is sometimes as much as 4 feet.

The *Arley Mine.*—This seam is only second in value to the *Cannel*, at Wigan. It yields a large quantity of gas, and its slack works into a fine coke. Its thickness varies from 4 to 5 feet, and it is raised from several very deep collieries at Ince, Gidlow Lane, Kirkless Hall, and Haigh.

PENDLETON AND CLIFTON DISTRICTS.—The coal seams of Wigan may all be traced eastwards to the Irwell, across the districts of

Hindley, Tyldesley, Hulton, Worsley, Clifton, and Pendleton; but they all undergo changes in quality and development upon reaching this position. Thus the *Arley*, *Haigh Yard*, and *Cannel* seams have degenerated and become of little value, while the three *Wigan* Mines are found to have as constantly improved, and in this state are known under the names *Trencher Bone*, representing the *Wigan* 9 *feet*; the *Five-quarters* and *Old Doe*, representing the *Wigan* 4 *feet*, and 5 *feet* Mines. Above these are the *White* and *Black* Mines, two valuable seams, especially the latter, and which, at Atherton and Tyldesley, unite to form a solid seam from 7 to 8 feet in thickness, of excellent quality; while at Clifton they are separated by 84 feet of strata. Above these, at a distance of 95 yards, is the *Rams Mine*, a thick and valuable seam, representing the Ince "7 feet" coal of Wigan. It is extensively wrought at Atherton, Tyldesley, Worsley, and Pendleton.* The highest workable coal is the *Worsley* 4 *feet*, a seam which has been very largely extracted along the southern margin of the coal-field, and is now being wrought at Bedford Colliery† by a shaft which passes down to this coal through the New Red Sandstone and Permian strata. This seam has been identified by Mr. John Hall and Mr. E. Binney with the "four-feet" coal of Clayton and Bradford Collieries in the Manchester coal-field;‡ but through some unexplained cause the underlying thick seams have never yet been reached beneath the Clayton coal, although sunk and bored for to a depth far below their position on the west side of the Irwell.

To the N.E. of the Great Irwell Valley fault we find several very thick seams, formed by the union of those which S.W. of this fault are more or less separate. Thus above the *Trencher Bone*, *The Doe*, and *Five quarters* Mines, we have the *Lower Three Yards Mine*, formed by the junction of the *White* and *Black* Mines; then a *Two Yards* Mine, representing the *Rams*, and the *Upper Three Yards*, formed probably of the *Crumbourke* and *Shuttles* seams. These seams have been, and are, largely worked east of Bolton, at Little Lever and Radcliffe Bridge. Over this tract the dip of the beds is steep, being from 25° to 35° towards the south and south-west.

Between Radcliffe Bridge and Middleton, and southwards to Whitefield, there is a considerable tract of country almost profitless for coal, or which contains only the *Royley* or *Arley Mine*. This latter seam, in the direction of Rochdale, is repeatedly thrown out by large faults.

OLDHAM AND ASHTON DISTRICTS.—Hitherto the general trend of the strata has been from west to east; but near Rochdale, Middleton, and Oldham, the beds are bent round, and henceforth trend to the south, rising towards the east at steep angles (25° to 40°), and cropping out by Oldham, Staleybridge, and Poynton.

The coal-series of Oldham, Ashton, and Dukinfield, contains about 38 seams, which have all been worked. As a general rule, however,

* At Pendleton Colliery, sunk through the edge of the Great Irwell Valley fault, this seam is worked by Messrs. Andrew Knowles and Son at a depth of 536 yards.

† By Messrs. S. Jackson and Co.

‡ On the *Lancashire and Cheshire Coal-field*. Trans. Geol. Soc., Manchester, vol. i., p. 73.

the seams at the eastern side of the Lancashire and Cheshire coal-field are thin, and much split up by partings of shale.

The *Royley* or *Arley Mine*, at the base of the middle coal-series, has been extensively worked around Oldham, and as far south as Lees, but has never been proved at Ashton-under-Lyne. Further south, it is considered, with great probability, to be represented by the Upper Woodley Mine, which has been worked in Cheshire, and upon this supposition we have been enabled to trace this remarkable coal-seam over the entire coal-field, with an area of nearly 200 square miles. It is considered, also, to reach into Yorkshire and Derbyshire, where it is called the *Black Shale* or *Clod-coal*.

The *Black Mine* forms the most valuable seam of this district: Oldham and Ashton are built upon it, and, consequently, the interior of the earth is perfectly honeycombed under these densely-populated towns. Under Oldham, indeed, little of this seam remains entire, and the workings have advanced towards the west and south, where a large area still remains, most of which is in the hands of the Chamber Colliery Company. It is this seam to which the Astley Pit of Dukinfield Colliery has been sunk, at a depth of 687 yards, the greatest yet attained by one vertical descent in Britain, if not in the world. The workings in this magnificent colliery extend, however, to a considerably greater depth even than this. The dip of the Black Mine being rapid, and the seam having been followed by a "down-brow" tunnel, a depth of, we believe, 2,500 feet from the surface has already been reached; and should it be found practicable to drive in the same direction to the extremity of the estate, a total depth of about 3,300 feet or more will ultimately be attained. We look forward with extreme interest to the progress of the workings of this remarkable colliery. Much light may be thrown on the effects of the weight of the superincumbent strata, the pressure of the atmosphere, the powers of ventilation, and of the increase of temperature at great depths. Already two of these influences, namely, the thrust of the strata, and increase of temperature, are making themselves very sensibly felt; but we feel sure that, under the skilful management of Mr. Charlton and his intelligent underlooker, these obstacles to the extraction of the coal will (as far as is possible) be surmounted.

The Black Mine varies in thickness from 4 to 5 feet, and at a short distance below it is a seam which yields a good cannel, about 18 inches thick at Dukinfield.

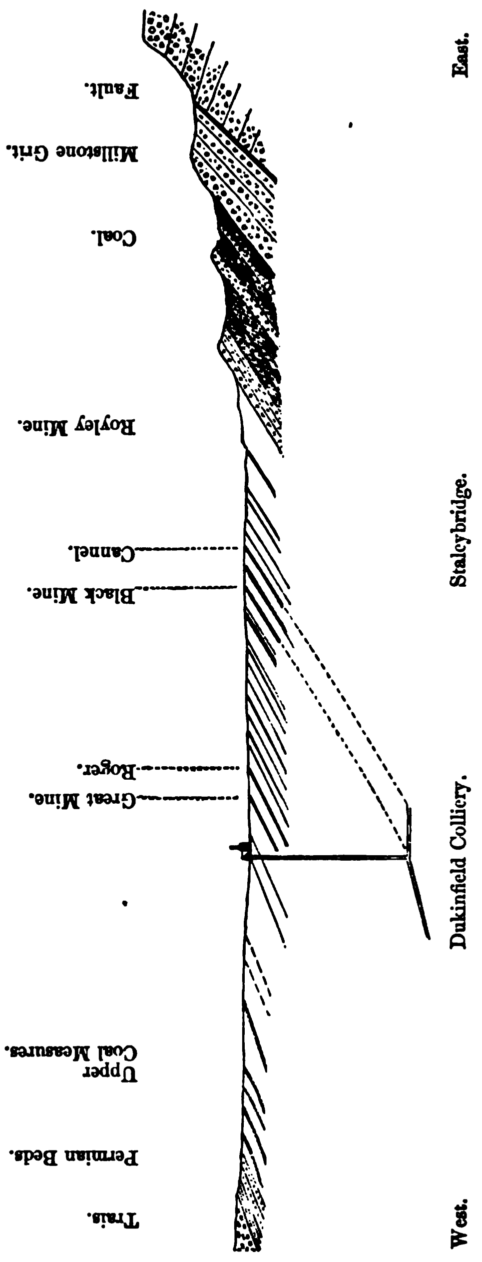
The uppermost workable seams are the *Great Mine* and *Roger*, both thick and moderately good coals; but owing to the small extent of surface which they occupy, they have not as yet been largely worked.

After crossing into Cheshire, the coal-field begins to contract in breadth, and ultimately ends off in a point in the direction of Macclesfield. This is owing to the existence of a large fault, which throws in the New Red Sandstone on the west against the Coal-measures which gradually rise and crop out southwards until ultimately the millstone grit reaches the surface. The vertical displacement of this fault must be several thousand feet, if not yards.

Having concluded our short account of the principal coal-seams, it may not be altogether useless or uninteresting to point out some of the districts where the coal lies for the most part undisturbed, and to

FIG. 2.

SECTION ILLUSTRATING THE GENERAL ARRANGEMENT OF THE FORMATION ALONG THE EAST SIDE OF THE LANCASHIRE COAL FIELD, AND THE WORKINGS AT DUKINFIELD COLLIERY.



which we may look for the future supply, when the mineral shall have been more or less exhausted in those localities where it is at present most largely mined. We shall presently offer some details, showing that the exhaustion is proceeding with accelerated speed, and it therefore becomes a question of importance, whether there are still remaining certain tracts as yet unopened up, where the coal may be found at a future day within workable depths.

We are glad to be able to state that as far as the Lancashire coal-field is concerned, there are several districts of considerable extent, where some of the most valuable seams lie in all their primeval integrity, at depths within a thousand yards, and therefore certainly available. That which is best known and appreciated is the belt of country lying to the north of the Mersey, and forming the southern limit of the coal-field. Although formed of New Red Sandstone and Permian strata, it is well known that the coal-seams dip under these newer formations, and have in several collieries actually been worked underneath. Of these we may mention the collieries of Haydock, Edge Green, Astley, Bedford, and Patricroft. It will, however, in all probability, be a long period before the New Red Sandstone is extensively invaded by coal-pits.

One of the most important districts for future supply is that which lies to the south and south-east of St. Helen's, and extends as far as the Railway Junction in the direction of the dip of the beds. At this deepest point the vertical distance to the St. Helen's Main Coal would be a little over 1,000 yards; and at every step nearer St. Helen's the depth would be lessened.

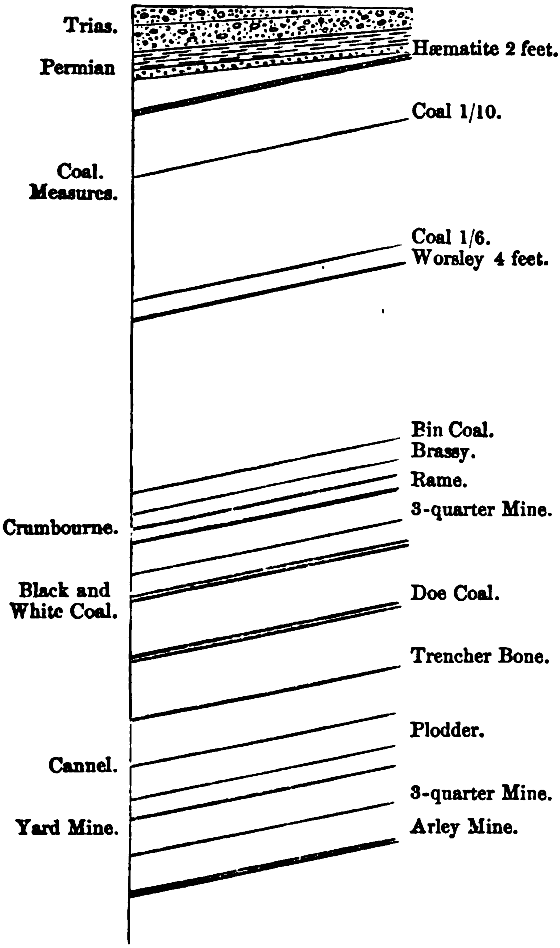
In the Wigan district, besides the "deep belts," in which the Arley Mine lies at a depth of 1,000 yards and upwards, with several shallower seams of great value, at still smaller depths, there is, also, the tract lying between Standish and Coppul, which has been very little explored, and which contains three or four seams of workable coal.

There is a considerable tract of virgin ground formed of upper coal-measures around Abram, and extending as far east as the great fault west of Bickershaw Colliery. Here several seams would be found at depths under 1,000 yards. Between Bickershaw Higher Hall and West Leigh Hall, there is another tract of upwards of a square mile in extent, where the coal lies as yet undisturbed. This band of coal-measures extends as far west as the large fault just referred to, which introduces the New Red Sandstone.

Perhaps the most important band of country for future coal supply is that which stretches on either side of the outcrop of the Worsley 4-feet seam, from the great fault which runs within half a mile to the N.E. of Leigh and Bedford to Monton, a distance from west to east of six miles. Over every portion of this tract, *on the north side of the outcrop of the Worsley 4-feet Mine*, all the seams, including the *Arley Mine*, may be reached at depths within 1,000 yards. South of this outcrop none of the underlying coal-seams have as yet been touched; and there is, therefore, an area of about 10 square miles, in which the *4-feet* coal lies at a depth considerably under 700 yards, and several deeper seams, such as the *Rams Mine*, under 1,000 yards. Many of these seams may be worked (as already hinted) under the New Red Sandstone, which runs for the most part parallel to the trend *or "levels"* of the coal-seams in this district.

FIG. 3.

GENERAL SECTION, SHEWING THE SUCCESSION OF THE COAL SERIES WEST OF MANCHESTER.



Proceeding eastward, the next district of reserve of special importance is that which lies along the northern outcrop or border of the New Red Sandstone and Permian strata from Ringley to Prestwich, and some distance further eastward. This tract is much obscured by sand and clay, so that the strata are rarely visible even in deep brook courses. Still, judging from the southerly dip of the coal-seams which reach the surface along the banks of the Irwell, as far east as Radcliffe Bridge, there can be little doubt that this district is full of coal. The construction of shafts will, probably, be attended with much difficulty and expense, owing to the depth of the running sand.

The Manchester coal-field ought, according to all the recognized principles of stratigraphical succession, to contain a vast supply

of coal below the seams now being worked; but from some unexplained cause these have never been reached in the trial-borings which have been made.

To the north and east of the margin of the New Red Sandstone, from Middleton to Denton, there runs a band of about ten square miles, stored with all the coal-seams of Oldham, Ashton and Dukinfield, but at greater depths as being further removed from the outcrop. On this tract is situated Mostyn Colliery, at which the upper *Great Mine* is worked at a less depth than 300 yards; consequently the *Black Mine* would be found at less than 1,000 yards at this spot, and throughout the greater part of this band of coal-measures the dip is likely to be found rather steep, and the ground considerably broken by faults.

There are, therefore, from 30 to 35 square miles of what may be considered as reserve-ground, plentifully stored with coal at depths varying from 2,000 to 4,000 feet, which is as yet scarcely broached.

FAULTS OR DISLOCATIONS.

The Lancashire coal-field is remarkable for the magnitude of the lines of fracture by which it is traversed, and in some parts bounded. The western boundary of the coal-field is a large fault, which throws in the New Red Sandstone along a line ranging from Lathom Park on the north, by Bickerstaffe and Knowsley Hall to Huyton and Tarbock. The throw of this fault may probably reach 1,000 yards in some places.

The "Great Up-Holland" fault, which ranges north and south by Pimbo Lane, has a throw of 700 yards. The effect of this dislocation is to reintroduce a large area of coal-ground to the west of its outcrop at Billinge, Orrell and Up-Holland. On this area—which is the nearest collieries to Southport and the northern suburbs of Liverpool—are situated the collieries of Rainford, Blaguegate, Swifts' Folds, Skelmersdale and Holland.

Of the five great parallel faults which traverse the Wigan district, the "Pemberton Fault" has a throw of 470 yards at Tan House Colliery; the "Shevington Fault" of 600 yards opposite the John Pit of the Kirkless Hall Company; the "Giant's Hall Fault" of 600 yards, west of Ince Hall Colliery; the "Standish Fault" of 160 yards at Amberswood Colliery; and the "Great Haigh Fault" of 600 yards near Kirkless Hall Colliery. In general, notwithstanding the magnitude of the vertical displacement occasioned by these great fractures, they are remarkably "clean," very little broken or barren ground being found on either side of them. They have proved of immense benefit to the mining operations of the district, as they form natural barriers for damming the waters in old workings. On this account great precautions are taken by colliery owners on both sides, that the natural sluices may not be cut through.

The Worsley district is traversed by three parallel faults varying east and west in the same direction as the outcrop of the coal-seams. The most southerly of these may be traced over five miles; the others for a less distance. The effect of these faults is to *repeat* several of the same seams twice, or thrice; so that in traversing the district from south to north (in the direction of the dip and rise) we

pass over the outcrop of the same strata twice or three times, according to position. The celebrated navigable tunnel, constructed by the great Duke of Bridgewater, traverses these strata. Entering the hill-side at the village of Worsley, where it joins the Bridgewater canal, it takes a NN.W. direction for a distance of nearly four miles, never again reaching the light, but communicating with the surface by several colliery shafts which are sunk close by its side. At its northern end it is about 285 feet from the ground. Its purpose was to serve, we believe, both as a means for draining the mines, and to afford canal transit for the coal direct from the galleries of the mines to the Liverpool and Manchester markets. The railway in course of construction across this part of the coal-field will probably render this underground canal of small economic value, but we cannot but admire the spirit of enterprise which prompted the execution of a work at once so costly and difficult.

The "Great Irwell Valley fault," which traverses the centre of Bolton and Manchester, has a down-throw to the north-east of upwards of 1,000 yards at Ringley: the amount of displacement being capable of demonstration from the position of the coal-seams on each side.

The fault which cuts off the strata of the Manchester coal-field on the west against the New Red Sandstone on the east, has a throw probably little short of 1,000 yards, and several others of very large displacement occur near Bury and Oldham. The direction of the majority of the great faults ranges north-west or NN.W., and they slope or hade very considerably. The average slope may be taken at 2 vertical to 1 horizontal of 25°; but there are instances of the slope being nearly as much as 2 horizontal to 1 vertical. This would appear to indicate that the fault had been produced principally through the influence of lateral tension, as it may probably be assumed that the amount of obliquity of any fault or system of faults from the vertical is in proportion to the horizontal pressure or tension. Their practical effect, however, is to render the position of each fault variable in different coal-workings. Thus we may find the same fault traced on the plan of a shallow seam at the horizontal distance of a hundred yards from its position in a deep seam; but if care be taken to mark the side of the downthrow, and proper allowance be made for the slope, all errors on this score may be avoided.

IRON ORES.

It is remarkable that there is not a single band of clay-iron stone at present employed for the extraction of iron in Lancashire: of blast-furnaces situated on the Lancashire and Cheshire coal-field, those belonging to the Kirkless Hall Company near Wigan are the only instances, and they are supplied with Ulverston ore, mixed with a little calcareous hæmatite from the upper coal-measures of Patricroft, near Manchester; of which we shall speak presently. The only instances we are acquainted with in which the argillaceous carbonates of the coal-measures have been used for smelting, are those which once existed near Burnley, at Haigh near Wigan, at Dukinfield, in Cheshire (which belonged to Messrs. Swire and Company), and at a place called Tunshill, near

Rochdale, in which a large sum of money was sunk with very little return. All these works are now extinct, and so long as the rich ores of Ulverston, Furness, and Cleator Moor are to be had in such abundance as at present, they are not likely to be revived.

The Lancashire coal-field is not, however, to be regarded as destitute of workable iron-stones. Throughout the whole of the lower, middle and upper series these ores are to be found, but especially amongst the upper series; some of them resembling the "black-bands" of other districts. We would particularly call attention to the instances of nodular or banded ironstones, which occur above the *Arley Mine*, north of Heywood; also to those which are shown in the banks of the Irwell, at Ashclough, and north of Clifton House; also to specimens shown in the brook below Seddon House, and which crop out along Haigh Wood, near Wigan, lying amongst the *Ince Mines.* There are also the bands which lie below the *Pemberton 5-feet Mine,* which have been worked by Mr. Stephens, of Pemberton; the black-band above the *cannel* of Wigan; and the carbonaceous black-band below the *Pendleton 4-feet coal,* found in sinking Mr. Fitzgerald's new pits, which is about 4 feet in thickness.* This latter has been analyzed by Mr. J. Leigh, F.C.S., and gave the following results, in 200 parts of average sample :—

Water	4.0
Bituminous matter and carbon	98.0
Silica	29.3
Silicates of iron, alumina, and lime	3.2
Alumina	4.5
Carbonate of lime	3.4
Peroxide of iron	57.0
Loss	0.6
	200.0

This would only produce about 20 per cent. of metallic iron, and cannot be regarded as a rich ore.

The most valuable band is that which is now being worked at Patricroft by Mr. Lancaster, and supplied to the Kirkless Hall furnaces, as it is found to mix well with the purer ore of Ulverston: the large proportion of carbonate of lime which it contains, amounting to about 40 per cent., enabling it to act as a flux. It occurs as a bed, dipping with the strata towards the south at a moderate angle. In thickness it is about 2 feet, sometimes less, and it is in the state either of a greyish carbonate or of a red-coloured peroxide. It yields from 22 to 26 per cent. of metallic iron, and is generally free from phosphorus or sulphur.

This band has, doubtless, a considerable horizontal range, but is concealed beneath the Permian and New Red Sandstone at Patricroft and all along the southern margin of the coal-field. In consequence of this it never actually reaches the surface west of Manchester, but irses at an angle of about 10° and strikes against the bottom of those newer formations which creep over the carboniferous strata at a more moderate angle. The same band may be observed in the banks of

* Mr. E. W. Binney, *On the Deposits of Iron-stone in Lancashire.* Mem. Phil. Soc. Manchester, vol. xii.

the Medlock at Ardwick, on the east side of Manchester, where the thickness appears to be rather less than at Patricroft. It is at this point in close proximity to the limestones of the upper coal-field, and we see no reason to doubt the practicability of raising and smelting the ore here with profit. The pig-iron would command a ready market amongst the large foundries of the neighbourhood.*

Progress of Mining Operations in Lancashire and Cheshire.—In a communication made to the Philosophical Society of Manchester, in March, 1854, Mr. Joseph Dickinson, inspector of coal mines, gave certain statistical returns regarding coal-mining in Lancashire and Cheshire, which, if compared with similar returns for 1860, from the "Mineral Statistics of Great Britain," by Mr. R. Hunt, of the Mining Record Office, will show the state of this branch of industry at the present day as compared with that seven years since.

Number of Collieries.—In 1853 there were 362 collieries, of which 28 belonged to Cheshire, and 334 to Lancashire; there are now 406, of which 35 are in Cheshire, and 371 in Lancashire; being an increase at the rate of 6.28 yearly. The actual number of new collieries opened each year is greater than this, as the figures represent the surplus of those opened above those which were closed.

PRODUCE OF COAL.

	1836. Estimate of Mr. Elias Hall.	1852. (Mr. Dickenson.)	1860. (Mineral Statistics.)
	Tons.	Tons.	Tons.
Lancashire ..	3,176,000	8,255,000	11,350,000
Cheshire	224,120	715,000	750,500
Total ...	3,400,120	8,970,000	12,100,500

Assuming the correctness of these estimates, we see that the increase from 1836 to 1852 has been 5,569,880 tons, or at the rate of 347,492 tons yearly; and from 1852 to 1860 it has been 3,130,500 tons, or at the rate of 392,562 tons yearly: so that the production has been governed by an accelerated rate of increase. Of this enormous quantity of coal nearly one million of tons is shipped to ports of the United Kingdom and foreign parts; a large quantity is sent southwards by the London and North Western Railway; but probably 9-10ths of the whole is consumed within the limits of the county.

The number of persons employed at the collieries, both above and under ground, in 1852, was 33,600, and may now be estimated at 43,000 in 1860.†

It is evident, from the above figures, that the annual production of coal is increasing with giant strides. The increase for the year 1860

* This band of ore was first identified with that of Patricroft by Mr. E. W. Binney, who has called attention to the importance of its occurrence in this neighbourhood. Trans. Geol. Soc. Manchester, vol. i.

† In some of the above estimates the Burnley coal-field is included. We had intended giving a special description of this small but rich basin, but, owing to the length the paper has already attained, feel it necessary to postpone this part of our subject. There are already two very complete notices of the Burnley coal-field; one by Messrs. Whitaker and Wilkinson, in "The Geologist," vol. iv., No. 47; the other by myself, in "The Coal-fields of Great Britain," 2nd edit., p. 132.

was nearly one and a half millions of tons over the produce of the previous year. The line of railway now in course of construction from Wigan to Patricroft, and which crosses one of the richest tracts of the whole coal-field, will probably add to the ordinary increase one million of tons for the year upon which it is opened. It is therefore almost certain that in a very few years the annual production will reach 15 millions of tons. Whether it will exceed this is a question we leave to events to show, but we do not apprehend a much greater increase than this. It is evident that the production of this or any coal-field which constantly tends to increase, must ultimately reach a maximum to be determined (supposing the demand and the necessary agency are forthcoming) by the capabilities of the coal-field itself. If the productive ground is fully occupied by collieries, each in full work, then the yield will have reached its maximum. The Lancashire coal-field is far from approaching such a state; but there are certain districts, of which St. Helen's, Wigan, Oldham and Ashton are the centres, where the coal is being rapidly exhausted; and, in proportion as the seams have to be followed from the outcrop in the direction of the dip, so must the number of the collieries decrease, and many seams be left behind which at small depths would have been workable. On these grounds we do not look forward to any very great advance in the quantity of coal annually to be raised in Lancashire.

The estimate of the resources of this coal-field (including that of Burnley), made by myself,* puts us in possession of data for determining with approximate accuracy the possible duration of the supply. I make the total quantity of coal still remaining, and within a vertical depth of 4,000 feet, to reach 3,990 millions of tons, which, at the rate of production for 1860, would be sufficient to last for 330 years. This, however, is the most favourable view of the subject; for should the annual quantity raised reach 15 millions of tons, the period would be reduced to 266 years; and, should 4,000 feet be found a depth too great for mining operations, this period will be still further shortened. In point of fact, however, the coal field can never be exhausted *suddenly*. In the ordinary course of events the production must gradually decline after the maximum has been reached, just as it has gradually augmented up to that maximum.

NOTE.—Mr. Elias Hall, in the year 1836, made an estimate of the resources of the coal-field, which, with proper modifications, agrees remarkably with and thus verifies my own. Neglecting what he calls "the lower and middle coal-fields," which include all the seams of the millstone grit, and lower coal-measures below the *Arley Mine*, he makes the quantity in the "Upper Coal-field" (including all the seams from the *Arley Mine* upwards) to reach 7,124,480,000 tons, to which is added for the Burnley coal-field 70,212,266: in all, 7,194,692,266 tons. He deducts one-fifth for pillars, &c., and 131,203,413 tons for the quantity worked out; leaving 5,624,550,400 tons. From this we must deduct 240,000,000 for the quantity raised

* "The Coal-fields of Great Britain," p. 135.

since 1836, and one-third of the remainder for seams which would be unworkable at depths over 2,000 feet. This leaves the available supply at 3,589,700,267 tons, which, it will be observed, is very near the estimate given above. I have been unable, however, to ascertain Mr. Hall's limit of depth.

On the Mexican Method of Amalgamation.

By JAMES NAPIER, JUN., F.C.S.,
Late Chemist and Assayer to the Guanaxuato Mint, Mexico.

§ I.—INTRODUCTION.

BEFORE proceeding to describe in detail the Mexican method of amalgamating silver ores—which will principally apply to those which came under my own observation at Guanaxuato—I propose making a few introductory remarks on the history of the Patio amalgamation process, and on the composition of the ores characteristic of some of the different districts.

The ancients were well acquainted with the property which mercury has of combining with gold and silver, and took advantage of the fact for removing gold from old apparel by first burning them to ashes in an earthen pot and then amalgamating them. Humboldt also states that, before the discovery of America, the Germans employed mercury to extract gold from auriferous sands as well as from iron and copper pyrites; but we have no knowledge of mercury having been employed for the purpose of extracting silver from its ores before the year 1557, when Bartolomé Medina, a miner of Pachuca, in the neighbourhood of Real del Monte, in Mexico, discovered the "Patio" method of amalgamation. It is very difficult to form any correct idea as to how this wonderful process was invented, and what it was that led to the discovery. It could not have been by chemical reasoning that Medina mixed the various ingredients—sulphate of copper, (magistral) salt and mercury—with the minerals of silver to extract the metal; and the discovery appears more extraordinary when we consider that the process requires weeks and even months for its completion, so that a long time had to elapse before the result of an experiment could be obtained. We can only suppose that Medina, being aware of the property which mercury has of combining with silver and forming amalgam—and also knowing that anhydrous sulphate of copper (obtained by calcining copper pyrites) when immersed in water gives out heat—conceived that if these were mixed with silver ore and common salt (which was thought to have a cleaning effect on the silver previous to its combining with the mercury), that the heat caused by the sulphate of copper would favour the amalgamation. Although this process requires a long time for its completion, the operation of reduction commences almost at once, so that by taking

out trials soon after the incorporation of the mass it could be seen that the mercury was taking up silver; and it would be easy to know, by burning at intervals a weighed portion of the amalgam, how much silver the whole quantity of mercury added would contain, and when the process was completed.

In 1586, a Peruvian miner of the name of Carlos Corso de Leca discovered what has been termed "*el beneficio de hierro*" (the reduction by iron). This consisted in adding to the *torta* small pieces of metallic iron, the object of which was to save mercury, which it would do by reducing the chloride of silver; but I am not aware of this process ever having been worked to any extent.

The next improvement made was by Alonzo Barba, in 1590. It consisted in amalgamating in large copper pans, heated from below, and was called "*el beneficio de caso y cocimiento.*" In this process there was a great saving of mercury, but a large consumption of copper, as the chloride of silver was reduced at the expense of the copper pans; it answers very well for the native chlorides, but not for sulphides of silver. In 1784, this process was introduced into Europe by Baron de Born, an Austrian mining officer, and from it has sprung the barrel amalgamation of Freiberg, proposed, I believe, by Gellert. So that from the process first invented by Medina, in Mexico, has sprung all others for amalgamating silver ores; and although his original process has undergone many alterations, the principle still remains the same.

Silver Ores of a few of the districts of Mexico.—I believe that every known ore of silver has been met with in some one or other of the numerous mineral districts of Mexico, but many districts have ores peculiar to themselves, and all ores will not yield their silver by the "patio" amalgamation.

Perhaps the ores of *Guanaxuato* yield their silver by the *patio* amalgamation better than those of other districts, from the fact of their containing but few foreign metals; the silver being mostly found in the form of pure sulphides, in many instances in carbonate of lime and quartz veins. The following shows an analysis of an ore from the district of "La Luz," in Guanaxuato :—

Silica	75·00
Silver	1·04
Iron	4·71
Carbonate of lime	8·25
" magnesia	3·26
Sulphur	6·79
Copper	·55
	99·60

This, however, is not to be considered by any means as an average sample of ore from this district, for the average richness of the ores produced here will probably not exceed from 45 to 60 ounces of silver per ton. Nearly the whole of the ores of this locality contain gold in various proportions. To show what proportion the gold bears to the silver, we subjoin the coinage of the mint of Guanaxuato for ten years, commencing at 1850.

COINAGE OF THE GUANAXUATO MINT FOR 10 YEARS.

Year.	Gold $	Silver $	Total $	Per Centage of Gold.
1850	709,472	7,801,300	8,510,772	8.336
1851	606,022	7,011,750	7,617,772	7.955
1852	746,956	7,625,650	8,372,606	8.921
1853	723,078	6,235,922	6,969,000	10.375
1854	450,288	5,029,712	5,480,000	8.216
1855	555,200	4,698,800	5,254,000	10.567
1856	479,476	4,306,524	4,786,000	10.018
1857	570,700	4,747,300	5,318,000	10.731
1858	489,744	4,725,256	5,215,000	9.391
1859	438,880	5,046,120	5,485,000	8.001

The ores of *Zacatecas* frequently contain argentiferous blende, which makes them rather more difficult to work than those of Guanaxuato. Gold was almost unknown in the mines of Zacatecas until 1856, when a vein was cut in the mine of the "Bote" containing large quantities of gold, which still continues to yield a considerable produce of that metal.

Real del Monte produces ores of a very various nature, some containing considerable quantities of manganese; as the following analysis of a sample by Mr. Rodgers, from the Santa Brigida vein in that district, will show* :—

Silica	68.00
Alumina	8.00
Peroxide and sulphide of iron	7.50
Magnesia	1.60
Sulphide of lead	2.82
Peroxide of manganese	5.30
Sulphide of zinc	2.30
Lime	1.45
Sulphide of copper	.40
Silver	.25
Potash, antimony, tellurium, traces of soda, gold and loss	2.38
	100.00

My late lamented friend Mr. Edward Louckner, who has examined these and similar ores very carefully, states that the silver in many cases exists as a manganate. The ores from the various mines of this locality differ very much in their nature and composition, and have consequently to be reduced by different methods: some are reduced by *patio*, others by barrel amalgamation, and some are smelted. Some

* See description of the Silver Mines and Amalgamation Process of Mexico, by John Phillips, Esq.

of the silver produced here contains sufficient gold to make its extraction a matter of importance.

In the district of *Anganjueo* the silver exists mostly combined with blende and sulphide of lead, and is reduced by smelting. The following analysis shows its composition :—

Zinc	52.09
Sulphur	32.00
Iron	13.44
Antimony	2.40
Silver	97
	100.9

In *Fresnillo* the ores worked do not perhaps exceed from 16 to 24 ounces of silver per ton, but the quantity operated upon is very large indeed, being about six thousand cargas* weekly: the grinding is partly carried on by steam power. There is but one reduction works in this locality, but it is the largest of its kind in the world. The ores contain no gold.

The district of *Catorce*, although now yielding comparatively little ore, formerly gave very large quantities of chloride, bromide and iodide of silver. These were reduced to a great extent by the "*Caso* process," or in copper pans. A large quantity of the ore from this district is also smelted in small blast furnaces. The ores contain no gold.

In the district of *Reyes* the ores differ very much in composition, as may be seen from the following analyses :—

	First.		Second.
Silica	50.000	Silica	24·00
Sulphide of iron ...	26·521	Lead	38·44
" silver ..	·150	Silver	2·75
" lead ...	2·076	Iron	6·50
" arsenic	·100	Antimony	15·17
" zinc ...	5·000	Sulphur	14·00
Sulphate of iron ..	·258		
" lime ...	·430		100·86
Oxide of manganese	3·540		
Carbonate of lime	4·160		
" magnesia	·960		
Moisture	6·800		
	99·995		

Some of the antimony in the second analysis existed as red sulphide. The first analysis may be taken as an average of the ores worked in this locality, although very frequently antimony is also found in various proportions. By the *Patio* amalgamation not more than from one-half to three-quarters of the silver can be obtained from these ores, and this only with a large loss of mercury. In examining various samples from this district, we have found part of the silver to

* A carga is equal to 300lbs.

exist in the form of *silicate*, which it is difficult to separate except by smelting; and the ores in general are not sufficiently rich to admit of this process being adopted where charcoal is so very expensive and scarce.

In the district of *Jalpa* a very interesting mineral of silver has been found, which, according to R. Richter, has the following composition :—

Silver	71·51
Copper	3·12
Iron	1·79
Sulphur	14·36
	99·68

Affording the formula ($\frac{3}{4}$ Ag + $\frac{1}{2}$ Cu)S. It has a lead-gray colour, and is malleable like ordinary silver-glance. Cleavage monometric, specific gravity 6·877 to 6·890. Breithaupt has given it the name of *Jalpaite*. (*American Journal of Science*, 2 ser., vol. xxvi. p. 358.)

In many of the mineral districts of Mexico there are thousands of tons of low-class ores which would not pay the cost of amalgamation. Various plans and apparatus have been proposed from time to time for concentrating these by washing, but up to the present time we know of none which has proved effective. Some of the machines have exhibited much skill on the part of the inventors, and for many classes of ores I have no doubt they might answer admirably. To concentrate these ores they would first have to be very finely ground, because the sulphide of silver is very intimately mixed with the gangue, and this operation is a very expensive one in Mexico, having to be done by animal power. Besides, in grinding, the sulphide being softer than the gangue, becomes so fine that the portion which passes away in the water used for washing contains in many instances as much, and sometimes more, silver than the portion remaining behind.

It may not be out of place just to remark here, that besides its wealth in silver, Mexico is much richer than is generally supposed to be the case in other metallic minerals. In the present condition of the country these are of course quite unavailable; but they present the elements of great future prosperity when law and order are restored, and proper security given to induce the application of the necessary capital to make them available. Many of these ores are distinctive in their composition, and are little known in Europe.

Government Aid to Science Instruction.

By E. H. Birkenhead,
Mining School, Wigan.

It is not yet generally known that a powerful impulse to scientific instruction in this country has lately been given by a system of government aid. Although at present in its infancy, the experiment has already been attended with important results. The arrangements are conducted by the Science and Art Department of the Committee of Council on Education,

in conjunction with local committees of not less than five well-known responsible persons. The Department of Science and Art holds in May of each year a public examination in every locality throughout the United Kingdom which complies with the requisite conditions. The examiners include most of the professors at the Government School of Mines, and several other eminent men of science. Mr. Warington W. Smyth, M.A., F.R.S., is the examiner in the subjects of Mineralogy and Mining; and Professor Ramsay, F.R.S., holds the same position with regard to Geology. The position of the examiners is therefore such as to give weight and authority to the results of the examination. This is very necessary in order that employers of labour should have confidence in the results where they are presented as tokens of efficiency.

The following are the branches of science which form the subjects of examination:—

1. Geometry, Mechanical Drawing, and Building Construction.
2. Mechanical Physics.
3. Experimental Physics.
4. Chemistry.
5. Geology, Mineralogy, and Mining.
6. Animal Physiology and Zoology.
7. Vegetable Physiology and Botany.

The character of the examinations may be judged of by the following questions selected from the examination papers of May last.

Geology.

4. How would you detect that a rock is limestone?

5. What is a conglomerate rock?

9. Construct a *vertical column* showing the chief British geological formations.

12. Of what materials has coal been formed?

13. How does coal lie among the strata, *and how was it formed?* and what metallic ore is worked to a great extent in the coal measures?

14. If a *trap dyke* (say of basalt or greenstone) is found to pass through coal measures, *what effect* would you expect it to produce on the beds of *coal* that it passes through?

15. What is a fault?

17. In what manner do copper, tin, and lead ores chiefly occur in the British rocks?

21. Name some of the *genera* or species of fossils found in the *carboniferous rocks*, viz., the *carboniferous* or *mountain limestone*, and the *coal measures*.

Mineralogy.

2. How are the different degrees of hardness of minerals best compared?

4. Give a full description of the physical and chemical characters of iron pyrites, mentioning its local appellations and the uses to which it is applied.

10. From what various minerals and localities is sulphur obtained?

12. Name and describe two of the most important zinc ores.

Mining.

2. What are the character and constituents of fire-damp?

3. State the circumstances in a colliery under which a Davy lamp ceases to be safe.

5. In what geological formations are the more remarkable repositories of copper ore worked?

7. State the principles of natural ventilation in mines.

10. What is the principle and construction of the plunger-pump or ram used in mines?

11. Describe the best method of blasting in hard rock.

12. Describe the method of "stoping" a vein, or of working coal in the district with which you are acquainted.

The above selection will show that the examinations are of an eminently practical character, and that they require such a knowledge as must be exceedingly useful to the miner. Several mining schools have consequently availed themselves of the opportunities thus offered.

The aid granted by the department is in the form of—

1. Payments to certificated teachers in charge of science schools and classes. The payments depend on the results of the examinations.
2. Grants towards the purchase of apparatus, diagrams, &c.
3. Prizes of books and medals to those candidates who obtain creditable positions in the examination lists. These prizes are granted, whether the teacher of the school be certificated or not, and they may be obtained by candidates who have not attended the school. The medals are, one gold, two silver, and three bronze, given to the six most successful candidates in each subject throughout the kingdom, if the degree of their proficiency be sufficiently high. The list of books from which the "Queen's Prizes" might be selected for the examination of May last included Brooke and Miller's "Mineralogy," De la Beche's "Geological Observer," Lyell's "Principles of Geology," Lyell's "Elements of Geology," Owen's "Palæontology," Hedley's "Working of Coal Mines," Phillips's "Metallurgy," &c., &c.

From returns recently published, it appears that at the examination held in May last, pupils from the following schools obtained prizes :—

Bristol Mining School	... ...	10 prizes.
Wigan Mining School	... ...	18 ,,
Cornwall and Devon Miners' Association		29 ,,

Two silver medals were awarded to Wigan, and one to the last-named institution. The Bristol Trade School (for boys) obtained no less than 57 prizes, one silver, and three bronze medals. The Andersonian University, Glasgow, obtained 7 prizes.

The scheme, of which the foregoing is an outline, is evidently susceptible of an enormous development. It may be made the means of conveying into mining districts some portion of that sound scientific instruction, which, while not in the slightest degree taking the place of practical experience, is yet a most important and necessary aid to the latter. It is to the officers of mines that the advantages of the arrangements are chiefly open; and even to those who do not care to go under instruction, they supply a means of obtaining a recognition of their scientific abilities. Whether the scheme be calculated to benefit the working miner to any considerable extent may perhaps form the subject of a future inquiry.

Abstracts and Reviews.

COMMERCIAL DETAILS CONCERNING COPPER SMELTING.

(From Dr. Percy's "Metallurgy.")

Freights.—Freight from Cornwall for all descriptions of copper ores was 3*s.* 6*d.* per ton, September, 1859. Formerly, this charge, inclusive of carriage from the mines to port, was 10*s.* per ton of ore delivered at the works; whereas, at present, these two charges average about 6*s.* 6*d.* per ton.

Freight of copper ore from Cuba to Swansea varies from £2. 10*s.* to £2. 15*s.* per ton of 20 cwts. Freight from Callao, South America, has been as low as £1. 16*s.*; in September, 1859, it was £3. 5*s.*, and outward to the same port £1. 17*s.* The Cuba freights are constant, and do not—like those from South America—vary with the price of copper. My authority for this information is Mr. Nicholson, who is largely engaged in the shipping trade between Swansea and South America.

Weights by which copper ore is sold.—The ore is sold in England by the ton of 21 cwts. (of 112 lbs. to the cwt., *i.e.*, 2,352 lbs. to the ton), estimated *dry;* but, if it is imported from abroad, it is the custom to allow the buyer 24½ lbs. per 21 cwts., *i.e.*, 2,376½ lbs. to the ton.

Cost of the Welsh method of copper-smelting.—There is reason to believe that metallurgical treatises and papers frequently contain statements as to the cost of production which are very erroneous, and may seriously mislead inexperienced persons. Not long ago it was gravely declared, at a meeting of the Society of Arts, that the average profits of copper-smelting were not less than 40 per cent. on the capital; and during the present year (1861) advertisements have appeared in the *Times*, under the sanction of respectable names, announcing the formation of a great Copper-Smelting Company with not less than £10,000,000 capital, and inviting subscriptions on the ground that 30 per cent. profit might be easily anticipated. The scheme may have been put forth *bonâ fide*, but I doubt not that its promoters were mistaken in their estimate.

No reliable *general* estimate of the cost of *smelting* copper can be furnished, as it must of necessity vary with the ever-varying cost of fuel, labour, iron, fire-brick and other materials; and this variation applies even to any particular works at different periods, while scarcely any two works are precisely similarly circumstanced. Thus at one establishment fuel now costs nearly double what it did some years ago at the pit's mouth, and wages are at least 10 per cent. higher. Then the cost of smelting a particular kind of ore varies much with the circumstances of the smelter's stock; at one period calcination may be saved by fortunate concurrence of another description of ore; and not only so, but the admixture be productive of cleaner than ordinary slag. On the other hand, every process may have to be encountered, and the result as to slag may be unsatisfactory. Besides, there is the cost of pulling down furnaces and the breaking up of furnace bottoms, and the conversion of their contents into marketable copper, together with many other uncertain contingencies constantly recurring in all large establishments of this nature, which make it impossible to offer a reliable general estimate. Nothing, in fact, short of an examination of a smelter's accounts would be any guide in a commercial point of view, and not even that unless the quantity of ore of each kind and its percentage of copper were set forth. But if the matter is looked at commercially, it will be perceived at once how little to be relied upon any such general estimate can be. Large quantities of copper ore are bought at the mines and carried at the smelter's expense to a shipping port. From one mine the carriage may be three shillings per ton, from another ten shillings; then there is freight to the landing place; and at one establishment the ore may be landed nearly at the furnace mouth, at another it may have to be transhipped into barges or loaded into railway waggons at an extra cost of some shillings per ton. Again, one smelter's furnaces may be near his market for copper, another's more distant, when transport becomes more costly. By way of example, it may be stated that in one case the cost of conveying copper to market, the cost of agency in selling it, and the discount allowed to purchasers for prompt payment, equalled the cost of making copper from some richer descriptions of ore.

Le Play has entered into elaborate calculations concerning the cost of smelting copper by the Welsh method; but, as it does not appear that he had access to the balance-sheets of the establishment in which he was permitted to study the process, the results at which he arrived cannot be received as authoritative. It seems hardly possible that any person, however perfect his knowledge may be of the theory and practice of copper-smelting, and however shrewd and expert he may be as an accountant, should be able to deduce with certainty the cost of production from the data which may be collected in works by personal inspection or elicited from workmen. From information on this subject which Le Play obtained at Swansea, he was led

to conclude that copper-smelting might be profitably conducted at Caronte, near Marseilles; and, for various reasons which he enumerates, he advised the erection of copper-works in that locality. He, moreover, expressed an opinion that there was no other locality in Europe in which the metallurgical treatment of copper ores by the *wet way* might be attempted with greater prospect of success.* In consequence of the publication of these opinions by Le Play, not fewer than four establishments for the extraction of copper were erected near Marseilles, known as the Usines de Caronte, de Rouet, de Septèmes, and de Bouc. The latter was destroyed in 1854, and in 1858 all had become defunct. The following comment appears in a notice of these works by Simonin.† "The particular position of Caroute had been indicated as the best for works in the south of France by an illustrious engineer, whose eminent talents have shed so great a lustre on the study of metallurgy, and especially on the metallurgy of copper—M. Le Play. But now the experience of years has destroyed illusions prematurely, perhaps, conceived, and the important problem of the treatment of copper ores in France appears beset with difficulties [et la question avantageuse du traitement du cuivre en France parait environnée d'écueils] except possibly in cases altogether exceptional."

A method intermediate between the Welsh and continental methods, similar to that recommended by Le Play,‡ was practised at these works. Both blast and reverberatory furnaces were employed. A notice of the *wet* method, which was also tried at Le Play's suggestion, is given at page 450.

Sir W. Logan's formula of the cost of copper smelting.—Sir W. Logan informs me that, when formerly engaged in copper smelting, he ascertained with great care the exact cost of each operation, and deduced the following formulæ for calculating the total cost of the entire process with ores of varying produce, namely, 10*s.* per ton of ore, with the addition of 2*s.* for every unit, *i.e.* 1 per cent., of produce as determined by the Cornish method of assaying. This formula comprises all expenses from the purchase of the ore (exclusive of Cornish carriage) to the refining of the copper inclusive; and he assured me that he found it applicable to all ores without exception. But it is obvious that it must vary with the *price of labour and fuel;* and both the important items of expenditure have advanced considerably since the days when Sir William, in conjunction with Mr. Starling Benson, carried on the business of copper-smelting. In conversing with a copper-smelter not long ago respecting the formula in question, he expressed his opinion that with 1*s.* 9*d.* instead of 2*s.* per unit of produce, a more correct estimate would be obtained. I have recently had the opportunity of inspecting an actual balance-sheet of one of the largest firms at Swansea, and I found that the formula, with the modification just mentioned, gave very nearly the same sum as charged in this balance-sheet for smelting costs. Supposing the average produce of the ores smelted to be 8 per cent., the cost of smelting one ton of copper will be

$$\frac{100 \times [10 + (8 \times 1s.\ 9d.)]}{8} = £15.$$

In the latter part of 1859 the miners received £90 per ton of copper in the ore, when the selling price of copper was £112. 10*s.* Hence, in smelting at that time there should have been £7. 10*s.* profit on smelting per ton of copper. But this would not represent the *actual profit* of the

* Procédés Métall., &c., p. 414.

† Notice sur les Usines à Cuivre et les Usines à Antimoine des Bouches-du-Rhône. Par M. L. Simonin, Ingénieur Civil à Marseilles, p. 535. Bulletin de la Société de l'Industrie Minérale, 3, 4ième Livraison, 1858.

‡ Procédés Métall., &c., p. 414.

smelter, as certain commercial expenses, such as discount, &c., connected with the sale of the metal, would have to be deducted.

According to one smelter the cost of reduction at large works with which he was connected was £1. 3*s*. 11*d*. per ton of ore on the average; and the cost on the ton of copper never exceeded £10, but was often less.

Cost of copper works and capital required.—The cost will obviously vary considerably with the locality and nature of the site; it may be necessary to construct expensive wharves or quays, and in every case a large piece of spare land is required on which to deposit slags, ashes, and other waste. I am informed that works on the *smallest* scale to afford any prospect of success should be capable of making 1,100 tons of fine copper per annum from a good mixture of ores yielding, say on an average, 10 per cent. Such works would contain about 18 furnaces (say 6 calciners and 12 others) with all the necessary accompaniments, and may be estimated at a cost of £9,500 or £10,000. The calciners may be estimated at £240, and the melting furnaces at £200 each, exclusive of workmen's tools, &c., The additional capital needed to carry on the concern in an independent manner should be £35,000, making a total of £45,000. If such works were judiciously constructed with a view to further extension, their capacity might be doubled at an outlay of about 50 per cent. of the original cost.

Fuel is the largest item of expenditure in copper works, and consequently a situation where suitable and cheap coal can be obtained is of great importance. The quantity of coal consumed will vary much with its quality, and in a greater or less degree with the nature of the ores and the economy of management; but it may be generally estimated that in works such as those supposed there would be an annual consumption of about 20,000 tons of coal, or for every ton of copper made from a mixture of ores yielding 10 per cent. of copper, 18 tons of coal.

The cost of smelting will vary materially with the rate of wages, prices of iron, bricks, and other articles which are largely consumed in copper works. It may, however, be estimated that in producing 1,100 tons of fine copper in such works, and from such ores as those above supposed, there will be an expenditure of £9,600, or about £8. 15*s*. per ton of copper produced. This is the cost of smelting only, exclusive of interest on capital, carriage of ores from mines to port, freight from ports to smelting works, cost of carrying copper to market, expenses attending purchase of ore and sale of copper, with other incidental charges, which vary according to circumstances; such as position of works with respect to supply of ore, proximity to markets, &c.

The profit in copper-smelting must depend in great measure on the possession of ample capital and the exercise of sound commercial judgment in the purchase of ores and the sale of copper. A series of advances in the price of copper may treble the ordinary profits of the smelter; and, on the other hand, a series of falls in the price may not only absorb the profits, but occasion loss. The price of copper is liable to oscillations so considerable, and sometimes so unexpected, as to render mercantile operations connected with the metal not a little uncertain.

The mistake is sometimes made of confounding the management of smelting works with the management of the mercantile business connected therewith—departments which are essentially distinct from each other. It is one thing to know how to *make* iron or copper, and it is another thing to know how to *sell* the metals. The possessors of mineral property would do well to bear this in mind. The proprietor of estates containing valuable measures of coal and ironstone, seeing the prosperity of a neighbouring ironmaster, who pays heavily for a lease of both, might be led to conclude that he ought certainly to rival, if not excel, this neighbour in prosperity by smelting his own ores with his own fuel; and he may make the experiment, and discover that he has been egregiously mistaken in his calculation. He may have succeeded in the metallurgical, but have signally failed in the mercantile part of the business.

Turning over capital.—Capital cannot be turned over in copper smelting more than 2½ times a year when trade is *good*, and 2¼ times is a fair average. It is questionable whether any concern, on an average of ten years, makes 13 per cent. on capital, inclusive of interest at 5 per cent. per annum. In exemplification of the fluctuating state of the copper trade, I may introduce the following facts, which I have received on authority: namely, during two years, about 1839, one of the largest and best-conducted firms in Swansea did not realize more than 5 per cent. per annum; and in 1860, another of the principal firms in Swansea actually lost money.

GEOLOGICAL SOCIETY OF LONDON.

At the meeting of January 8th, Sir C. Lyell, F.G.S., in the chair, Charles Sturtivant Wood, Esq., Geological Survey of Otago, New Zealand; Robert Harris Valpy, Esq., Enborne, Hants; and W. S. Horton, Esq., 10, Church Street, Liverpool, were elected Fellows.

The following communications were read:—

1. "On the Carboniferous Limestone of Oreton and Farlow, Clee Hills, Shropshire." By Professor John Morris, V.P.G.S., and George E. Roberts, Esq. With a Note upon a new species of *Pterichthys*; by Sir P. de M. G. Egerton, Bart., M.P., F.G.S.

The rocks described in this paper are a series of thin beds of limestone and sandstone lying between the Old Red Sandstone of South Shropshire and the Millstone Grit which forms the basement of the Titterstone Clee Coal-field.

In consequence of the opening of new quarries and the cutting of a roadway through the Farlow Ridge transversely to the strike of these deposits, the authors were enabled to add somewhat to the description of the locality given in "The Silurian System." The series of deposits from the Old Red "cornstone," upwards, was shown by them to be:—1. Laminated yellow sandstones, with pebble-beds and sands. 2. Bright-yellow sandstones containing *Pterichthys*. 3. Brecciated yellow sandstones, pebble-beds, sandy layers, and laminated sandstones. 4. Sandy and concretionary limestone. 5. Grey oolitic limestones, containing palatal teeth of great size. 6. Clays, with ferruginous bands. 7. Shaly crinoidal limestones. 8. Clays with limestone-concretions, and shaly limestones. Against the last-mentioned bed, the Millstone Grit rests unconformably.

These beds thicken out at Oreton, a mile east of this Farlow section, and are there extensively worked for various economic purposes, the oolitic limestones, locally termed "jumbles," being used for decorative purposes under the name of "Clee Hill marble." In describing the physical conditions of the localities, mention was made of the "mole river," which losing itself at the west end of the ridge, takes a subterranean course nearly parallel with its axis, and reappears at its lower end, a mile distant. An interesting fact was communicated to the authors by the Rev. J. Williams, of Farlow, of an accidental accumulation in the hollow of its inlet, of a body of water estimated at 1,635,000 cubic feet, the whole of which was carried away in 48 hours by the sudden clearance of the channel.

In describing the palæontology of these rocks, the authors specially drew attention to the fortunate discovery of the Yellow Sandstone of Farlow, of *Pterichthys macrocephalus* (spec. nov., Egerton), made while reducing the thickness of a large ripple-marked slab sent them by Mr. Weaver Jones in illustration of the physical conditions of the deposit. This *Pterichthys* proving identical with the fragment previously found in the Farlow sandstone by Thomas Baxter, Esq., F.G.S., they attached to the paper a descriptive note on that fossil, by Sir Philip Egerton, in which the Farlow *Pterichthys* was contrasted with that of Dura Den, and additional proof given of the identity of the genera *Pamphractus* and *Pterichthys*. In addi-

tion to Pterichthyoid remains, scales of two species of *Holoptychius*, one probably new, had been found by them.

The richness of the overlying limestones in palatal teeth was shown by a fine series of examples, amongst which *Orodus ramosus*, of unusual size and in perfect condition, and an undescribed *Pœcilodus*, of great magnitude, were most conspicuous. Other genera represented were *Helodus*, *Psammodus*, *Cladodus*, *Cochliodus*, *Petalodus*, and *Ctenoptychius*. Ichthyodorulites, of large size and rich ornament, chiefly belonging to the genera *Ctenacanthus* and *Oracanthus*, accompany these teeth.

The notices of the invertebrate fauna given by the authors proved the assumed lowness of the Oreton limestones in the Mountain-limestone series,—the zone of *Rhynchonella pleurodon* being well marked, Crinoidal and Bryozoan remain abundant through fragmentary, and Corals nearly absent.

A large series of *Pterichthyes* and of rock-specimens were exhibited in illustration by Mr. George E. Roberts; and a collection of palatal teeth was liberally sent for exhibition by W. Weaver Jones, Esq., of Cleobury Mortimer, and by Edward Baugh, Esq., of Bewdley.

2. "On some Fossil Plants, showing Structure, from the Lower Coal-measures of Lancashire." By E. W. Binney, Esq., F.R.S., F.G.S.

After noticing the views taken of the structure of *Lepidodendron* by Hooker and others, the author proceeded to describe three portions of calcified stems lepidodendroid in external appearance, two of which exhibit in section a central axis composed not of cellular tissue but of large, transversely barred, hexagonal vessels. These two specimens the author refers to a new species, *Sigillaria vascularis*. The third specimen differs from the others in the absence of the thin radiating cylinder of barred vessels around the central axis; this he terms *Lepidodendron vasculare*.

Microscopical preparations and photographs of sections were supplied by the author.

3. "Supplemental Notes on the Plant-beds of Central India." By the Rev. S. Hislop. In a Letter to the Assistant-Secretary.

Mr. Hislop, in noticing the discovery of more remains of Plants, Insects, and Fishes at Kota on the Pranhita, stated that he certainly now thought that the ichthyolitic beds of Kota (probably lower-jurassic in age) are higher in relative position than the plant-sandstone of Nagpur, which, with the Sironcha sandstone underlying the Kota Limestone, belong to the Damuda Group, He remarked also that, in his opinion, the *Tæniopteris* of Kampti would prove that the Damuda and Rajmahal groups cannot be widely separated.

The last meeting of the Society was held (at Burlington House) on January 22nd, when the following papers were read:—

1. "On the further discovery of Flint Implements in Gravel near Bedford." By James Wyatt, Esq., F.G.S.

2. "On the Hyæna-den at Wookey Hole near Wells." By W. Boyd Dawkins, Esq., F.G.S.

3. "On the Drift containing Arctic Shells and other Fossil Remains, in the neighbourhood of Wolverhampton." By the Rev. W. Lister, F.G.S.

THE MINES OF RIO TINTO.

Notes on the Mines of Rio Tinto, Province of Huelva, Spain. By Joseph Lee Thomas, Assoc. Inst. C.E. London: Warren Hall and Co., 42, Cornhill.

In this pamphlet of 32 pages, Mr. Thomas has succeeded in giving a most valuable description of the mines of the province of Huelva lying in the neighbourhood of Rio Tinto, and of the metallurgical processes by which the

ores are treated, and their commercial results. The pamphlet is evidently a business statement, probably prepared with immediate reference to commercial purposes, and consequently should scarcely be regarded or criticised as a scientific paper; but we can safely say that it is a clear, and we believe perfectly sound and accurate description of the important mines in question—clearer and sounder than others of infinitely greater pretensions—and one which will be read with very general interest.

The remarkable mineral deposits in the neighbourhood of Rio Tinto are only paralleled in these islands by the great pyrites deposits on either side of the Ovoca valley, in the county of Wicklow. They are both essentially deposits of iron pyrites, containing a small per centage of copper pyrites, which occur in great masses, often lenticular in form, and having the same direction and dip as the strike and inclination of the rocks they traverse. As in the case of the Wicklow Mines, the Rio Tinto deposits are also accompanied by a zone of porphyritic rock often forming the wall of the deposits. In both cases the pyrites deposits are likewise often covered by a surface formation of oxide of iron; indeed, on the whole, their points of similitude seem to be very striking, except that the Spanish deposits are on a very much larger scale.

The following extracts from Mr. Thomas's pamphlet will put the reader in possession of some of the more prominent facts of this remarkable district:—

"The mines of Rio Tinto are situate in the north-west of the province of Huelva, about twelve leagues to the west of the city of Seville, and eleven to the north-east of the town of Huelva, the capital and shipping port of the province whose name it bears.

"The mine of Rio Tinto does not stand alone in the province, but is one of many which the ancients have worked in a zone of metalliferous rock, which may be described as having Castillo de las Guardias for its most western, and Grandola in Portugal for its most eastern limit. In Portugal, and near to the river Guadiana, the mine of San Domingo is being very profitably worked by English adventurers.

"The mining district under consideration extends thirty-six leagues from east to west. The formation is the clayslate, destitute as far as is yet known of fossils. The strike of the slates is from east to west, and the dip (except where disturbed by eruptive rocks) north—the angle varying but little from the vertical. Within the limits we have indicated the slates are traversed by porphyritic eruptions, and it is near the line of contact of the schist and porphyry that the deposits of ore generally occur. These masses of mineral are usually lenticular in form, and have the same direction as the strike of the rocks they traverse. They are found sometimes entirely imbedded in the porphyry, at others entirely in the schist, but most often I think with the porphyry forming the northern wall, and the slates the southern one of the deposit. The want of characteristic fossils prevents one classifying the slates with certainty, but they most likely belong to the lower silurian formation. The ore is essentially iron pyrites, but is accompanied by a small per centage of copper pyrites and some silex, say one to two per cent.; galena and blende are also found in small quantities disseminated through the mass. In the process of calcination the ore gives off large quantities of arsenious acid, the arsenic very probably being present as arsenical pyrites.

"Alternating with the deposits of iron pyrites are others of manganese. The outcrop of these latter is very marked, and it is curious that they should so long have escaped attention. Numerous mines of manganese (pyrolusite) are however now being worked, and large quantities of very pure ore, assaying sixty-three per cent., raised and exported to England. Its price, delivered at Huelva, is 12 reals per quintal, or £2. 15*s*. per ton.

"The mines of the province of Huelva are supposed to have been worked by the Phœnicians, Carthaginians, and Romans. That the Romans worked

them there is abundant proof: that the Phœnicians and Carthaginians did is a mere hypothesis."

"The mines of Rio Tinto have been worked more or less by the Spaniards and foreigners since 1727, but it is only since 1783, in which year the government took them into their own hands, that they have assumed any importance. From A.D. 1783 to1810, the copper made was 287,649 ars. or 3,269 tons; its cost to the state was 41,192,081 R. Von, or £429,084. 3*s*., equal to £131. 5*s*. per ton. From A.D. 1810 until 1825, owing to the disturbed political state of Spain, the mine was almost abandoned, and the quantity of copper produced was insignificant. On the 6th of December, 1827, the government issued a real order ordaining the leasing of the mines for twenty years to any foreigner or Spaniard, subject to certain conditions. On the 24th of April, 1829, they were handed over to Gaspar Remisa, on conditions that he should pay an annual rent, for the first ten years of the twenty for which they were leased, of 260,000 R. Von, or £2,708 sterling; and, for the second ten years, of 310,000 R. Von, or £3,229. Of the 150 houses which then comprised the village of Rio Tinto, 136 were placed at the disposition of Remisa, as also were the pine forests comprised within the limits of the sett, and valued at £15,000.

"Remisa's lease expired in 1849, and since that time the government have worked the mine—which he appears to have left in a ruinous condition—on their own account. From A.D. 1849 to 1858 inclusive, the copper made appears to have been 525,095 ars. or 5,967 tons, equal to an average annual production of 597 tons nearly. The ore extracted during the same period is given at 27,919,008 ars. or 317,261 tons, which, compared with the produce of copper stated above, would give 1·88 per cent. as the actual yield of the ore. This is, however, higher than the result really obtained, inasmuch as in the 5,967 tons is included the copper produced by the cementation of the water issuing from the mine, which has of late years yielded 16,000 ars. of precipitate, or more than 100 tons of fine copper annually. Taking this into consideration, 1·50 per cent. would be approximately the yield of the ore during the period in question.

"In March, 1849, the government entered into a contract with a private company entitled Los Planes, by which they bound themselves to supply monthly to the company 25,000 quintals or 1,136 tons of ore for fifteen years, receiving in payment all the copper obtained, the minimum accepted being 1¼ per cent. of the ore delivered. They also agreed to pay the company of Los Planes 56 reals per aroba, or £50. 2*s*. per ton for the refined copper returned to them.

"To another company called La Cerda, the government contracted to supply half the surplus ore remaining in their hands after completing the above contract, subject to the same conditions as in the case of Los Planes, with the exception that in the latter instance the amount paid by the state to the company for the manufacture of the copper was stipulated at 50 reals per aroba, or £45. 17*s*. per ton.

"The copper manufactured by the above companies is included in the 5,967 tons given as the produce of the mines from 1849 to 1858 inclusive. The largest per centage obtained in any one year by the Fabrica de los Planes was 1.75 per cent. of the ore delivered to them; but of late years the yield they have obtained from the ores has but slightly exceeded the 1¼ per cent. stipulated for by the government. This apparent falling off in the per centage of copper obtained from the ore delivered to the Fabrica de los Planes is traceable to two causes. The first, and perhaps the one which most conduces to this result is, that the government engineers have of late years taken more care to obtain from the waters issuing from the mine the copper contained in them, instead of allowing the Los Planes company to benefit by their negligence in this particular. They have also, I am told, exercised a stricter surveillance over the distribution of the ore to the various cementing

floors, and have not allowed the company in question to select the richer mineral.

"Within the boundaries of the sett there are three lodes, which traverse it from east to west. The northern and central ones are apparently divided, for the greater part of their length, by a wedge of porphyry, but meet at their eastern extremities; they may be regarded as forming one deposit divided for a part of its length by a wedge of sterile ground. Their length would seem from surface indications to be about 2,500 metres.

"The southern lode or deposit is to all appearances of greater length than the northern and central ones, and is separated from them by a larger wedge of country than they from one another. It is to this deposit that the workings of the Spaniards have been confined. The lode has been opened up by them for a length of 500 metres, and its average width for that distance has been 71 metres nearly. The levels driving east and west are both in ore.

"The mass of ore does not make to the surface, but is covered with a deposit of oxide of iron, more or less mixed with decomposed porphyry, and varying in thickness in different localities; for the length of 500 metres, for which the mine is worked, the thickness of this deposit is about 25 metres.

"The line of junction between the covering and the mineral is regular and unbroken, and looks more like the work of human hands than a natural formation. At the Lagunazo Mine, where works have lately been commenced by an English company, ore has been cut at a depth of seven metres only from the surface: this I am inclined to believe is no special instance.

"The outline and extent of the deposits of ore contained within the Rio Tinto sett are not sufficiently well known to admit of any estimate of returns being submitted, based entirely on such information. That possessed is, however, ample to warrant the inference that the quantity of ore it is possible to extract within a fixed period will be limited rather by external circumstances than by the capabilities of the mine itself.

"The mineral extracted from the present limited field in 1858 and 1859 respectively was:—

	Quintals.	Tons.	PER MONTH. Tons.
In 1858	982,647	44,665	3,722
„ 1859	1,330,140	60,460	5,038

During the latter year the present manager, Dr. Ramon Figueroa, has, I am told, done all in his power to increase the returns, and that the great difficulty he has had to deal with has been the deficiency of skilled mining labour.

"From Dn. Juan Aldana, formerly government engineer and director to the mines of Rio Tinto, I learned that the average cost of raising a quintal of ore there was 1 rl. 15 c., and per ton of 22 quintals, 25 rls. 50 c., or 5*s*. 3½*d*. For 1859, the cost was given me as 1 rl. 8 c. per quintal, equal to 23 rls. 76 c. or 4*s*. 11¾*d*. per ton, divided as under:—

Breaking, 69 rls. 24 c. per cubic metre - -	66c. per quintal.
Wheeling - - - - - -	20c. „
Hauling - - - - - -	22c. „
	1 real 8c, per quintal.

The above cost does not, I believe, include the maintenance of the hauling machinery and superintendence.

"At El Tharsis the cost was stated at 24 rls. or 5*s*. per ton.

"At the Chaparita Mine, where the lode is of less width, the cost of breaking and raising to surface was stated at 1 rl. 21 c. per quintal, or 26 rls. 62 c., equal to 5*s*. 6½*d*. per ton.

"The mean of the above is 5*s*. 2¼*d*. per ton."

The next, and most important, portion of Mr. Thomas's pamphlet relates to the metallurgical modes of treating the ores—particularly in their commercial bearing.

The mean assay of the quantity of copper contained in the Rio Tinto ores does not seem to be a settled question, but Mr. Thomas considers the nearest estimate to be about 3½ per cent. The various processes by which the copper is at present extracted, and the cost of each by the cementation process, is thus described.

"The ore first undergoes a calcination, the object of which is to convert the insoluble sulphuret into a soluble sulphate; after this is effected, it is put into tanks which are then charged with water. The water, when it is drawn off into other tanks, contains salts of iron and copper in solution; the latter is then precipitated with pig iron. The resulting precipitate is made into balls, which are calcined, and afterwards reduced to black copper in a German blast hearth, and refined in a reverbatory furnace. The refined metal is not ladled direct from the furnace, but is run into an exterior basin placed at the back, from which it is ladled into moulds. The slags of these two operations are reduced in a Castilian furnace.

"The calcination is effected in heaps, varying in dimensions; a common measurement for the base of the truncated pyramid is 12 metres by 7 metres; the usual height is about 1 metre: such a heap contains about 4,000 quintals of ore, and requires to light it 200 cargas of barda,* at 2½ reals per carga, and 25 cargas of cepas (roots), at from 3 to 4 reals per carga.† The cost of calcination at the Rio Tinto mines, labour and fuel included, was, in 1859, 36 cents per quintal of ore, equal to 1*s.* 7¾*d.* per ton. The time required to complete the operation is from five to six months.

"The heaps are open to the air and have no covering of any sort. The prevalence of wind and rain consequently exercises a considerable influence over the calcination. During five months of the year heavy rains are common in Spain, and a great proportion of the sulphate of copper must be washed away as soon as formed. The exposure to strong currents of air gives rise to the fusion of a considerable proportion of the sulphurets and the decomposition of the sulphates which pass into oxides and insoluble salts. To the above causes is in no small degree attributable the small yield of copper obtained from the ore in the after process of lixiviation.

"The calcined mineral is carried on the backs of mules or donkeys to the lixiviation tanks. These are generally constructed of rough masonry, and lined with asphalt; their dimensions vary considerably, but the most common size is 7 metres long by 4½ wide and 1 deep. They are two-thirds filled with ore, and contain about 2,000 arobas, say 23 tons nearly. The length of time the ore is allowed to remain in the tanks varies in different establishments; it depends on the quality of the ore, and the greater or less perfection of the calcination. At Rio Tinto from seven to nine days are usually considered sufficient. In the establishment of La Chaparita it is often as long as twelve days. The waters are drawn off and renewed as often as is considered necessary. The first water is saturated in two or three hours, and the last is left as many days.

"From the lixiviation tanks the water charged with salts of iron and copper pass to those of cementation; the latter being of nearly the same form and dimensions as the former. In them are placed piles of pig iron forming squares.

"During the winter months it is found necessary to agitate the water to accelerate the precipitation of the copper, but during the prevalence of the hot weather this is not much practised.

"When the solution has been sufficiently impoverished, it is drawn off into a third tank, and left to deposit the subsalts of iron held in suspension: the

* The local term for the brushwood of the district.

† The carga varies from 5 to 6 arobas in weight.

resulting precipitate is found to contain 10 per cent. of copper and a good deal of arsenic.

"After the solution has been drawn off from the cementation tanks, men are put to clean the pigs of iron of the scales of copper adhering to them and to collect the precipitate. This assays about 55 per cent. for copper, and varies from 50 to 60 per cent.

"The iron consumed in cementing at the Rio Tinto mines for the year 1859 was 2.17 to 1 of copper.

"The precipitate is collected in heaps and made into balls of about 5 inches diameter, and calcined in furnaces.

"The quintal of calcined mineral costs for expenses of lixiviation and cementation 1 real 72 c. or 4¾*d.* nearly.

"The precipitate is reduced to black copper in a German blast hearth, capable of treating in twenty-four hours about 176 arobas, or 2 tons. The fuel consumed (charcoal) varies from 30 to 34 per cent. of the weight of the precipitate smelted. The charge consists of 28 arobas of precipitate, and the number of charges treated in the twenty-four hours depends on its greater or less purity.

"The cost at Rio Tinto for 1859 was given me as 1 real 13 c. per quintal of precipitate. At La Chaparita, where the marcilla of charcoal costs only 2¼ reals, the cost is stated to be 1 real 25 c. per quintal.

"The refining furnace will treat 220 arobas of black copper in twenty-four hours. The fuel consumed is about 220 arobas of pine wood, and the yield of fine copper from 84 to 90 per cent. of the black copper charged. The cost of refining at Rio Tinto for the year 1859 was 2 reals 68 c. per aroba of fine copper produced, and at La Chaparita 2 reals 35 c."

"The rich slags from the German hearth and refining furnace are reduced in a Castilian furnace. In twenty-four hours the matter charged usually consists of

90	arobas of rich slags,	assaying 18 per cent.	
120	,, flux	poor slags.	
210	arobas.		

The cost is as under:—

Fuel—50 marcillas, equal to 58 arobas of charcoal, at 3 reals	150
Labour	88
R. Von.	238

The black copper yielded by the above quantity of rich slags would be 20 arobas, and the cost per aroba 11 reals 90 c. At Rio Tinto the actual cost for the year 1859, of black copper assaying 85 per cent., was 12 reals 50 c. per aroba. At the Chaparita establishment the cost was 11 reals per aroba."

The question of the total cost of producing copper at Rio Tinto is next discussed, affording the following results:—

"Dn. Ramon Figueroa, the director of the Rio Tinto mines, assured me that, for the year 1859, the total cost of the black copper produced, for mining, cementation and smelting charges, was 53 reals 96 c., and that it yielded 84.89 per cent. of fine copper. Assuming this, the cost of an aroba of copper will be—

	Reals.	cents.
For black copper	63	56
Refining charges	2	68
R. Von.	66	24

Supposing the ore to yield 1¼ per cent., to compare the above result with the contract price paid to the company of Los Planes, we must deduct from it

the mining charges on 16·66 quintals of ore, the quantity required to produce 1 aroba of fine copper.

	Reals.	cents.
Cost of fine copper as above...	66	24
Less mining charges on 16·66 quintals of ore, at 1 real 8 c.	17	99
Cost to the government of cementing and smelting ... ... R. Von.	48	25

"The company of Los Planes receive 56 reals per aroba, and the cost to the government is 48 reals 25 c. The profit, then, of the former may be estimated at 7 reals 75 c. per aroba."

Upon this basis of calculation, Mr. Thomas estimates that the profits of the Spanish government should realize on the present annual production of 60,460 tons, at £25,026. 13*s*.

Mr. Thomas at this point makes a short digression for the purpose of comparing the results obtained by the Rio Tinto system, and those arrived at at Agordo, in the Venetian States, an establishment worked by the Austrian government, where cupriferous pyrites, containing little more than 1½ per cent. of copper—not half the produce of that of Rio Tinto—is successfully treated. This process is elaborately described in Dr. Percy's "Metallurgy," pages 439-447, to which we refer our readers for a detailed and scientific description. The essential point is what is called "kernel-roasting," which is at present performed in "styrian kilns," which are found to answer decidedly better than the old method of roasting in piles or open heaps. Drawings of the kilns, and full details as to the mode of charging them, are given by Dr. Percy. As to the latter, the principal point seems to be to arrange the charge in alternate layers of *large* and *small* ore, and to place at intervals some beds of chips. The roasting occupies five or six months—about 288 tonnes being treated at a time. After this roasting process is completed, the charge is removed and the lumps of ore broken, when they are found to contain a "kernel" of enriched copper regulus enclosed in earthy shells of oxide of iron. The theory of the mode in which this concentration is effected is not very clear. Of the explanations which have been offered by continental chemists, Dr. Percy remarks: "these, as far as I can understand them, appear to amount to little more than a detail of certain reactions, which while they tend to explain the formation of regulus of copper, yet fail to render a rational account of the cause of the actual transference of the metal from every part of a lump of ore and its concentration in a small space in the centre. The phenomenon has been regarded as somewhat, if not strictly, analogous to what takes place in the formation of steel by the cementation process. ......But this process of cementation is still very obscure, and as much needs explanation as that of kernel-roasting itself."

In the Agordo process the total loss amounts to less than 10 per cent. of the copper contained in ores yielding originally but little more than 1½ per cent. In the Rio Tinto process, the loss is upwards of 50 per cent.—ores containing 3½ per cent. of copper not turning out more than 1¼. As to the possibility of introducing the former process into the Spanish mines, Mr. Thomas remarks:—

"Under existing circumstances the dearness and scarcity of fuel at Rio Tinto renders difficult the entire adoption there of the routine of cementation practised at Agordo; but in any case the existing method might be advantageously modified. I am by no means certain that a sufficient supply of brushwood could not be obtained at Rio Tinto to effect the reduction of the rich ore, matt, and precipitate in suitably constructed reverbatory furnaces; and if so, the Agordo system could be adopted in its entirety.

"In Spain the duty on copper is 3 per cent., but in addition to this the mines of the Huelva district pay the government an enormous duty on the

pig iron consumed in precipitating it. In levying this the State does not even consult its own interests, leaving out of the question those of the industry of the country. Were the duty on the pig iron used in cementation removed, a second calcination would soon become universal among the establishments of the province of Huelva, but at present the larger per centage of salts of iron contained in the solution obtained from the ore that has undergone a second calcination and consequent increased consumption of pig iron in precipitating the copper, deters the various companies from practising it. This objectionable tax removed, the mines would make more copper from the same quantity of ore, and the government realize the 3 per cent. duty on the greater quantity."

Mr. Thomas now turns to a consideration of the results that would attend the working of the Rio Tinto Mines, when connected by railway with Huelva. This he considers under three heads, the profits of the railway being estimated under any circumstances at at least 17 per cent.

"1st.—The financial result that would attend the exportation of the whole of the ore raised.

2nd.—Do., the smelting at the Rio Tinto mines of the whole of the ore raised.

3rd.—Do. do. at Huelva."

All based upon a raising of 120,000 of ore per annum; that is, double the present returns—an amount that could undoubtedly be easily reached.

Under the 1st head, exportation of the whole of the ore, he arrives at an estimated profit of £161,917 per annum; *assuming that the increased supply of ores in England would not materially affect the market value.*

Under the 2nd head, the reducing of the ores at Rio Tinto, by means of fuel carried up by the railway, he arrives at an estimated profit of £92,125 per annum. He recommends the use of a blast-furnace instead of a reverbatory one, as the more economical.

Under the 3rd head, the reduction of the ore at Huelva, he arrives at a profit of £41,275, exclusive of any value to be derived from the sulphur. As to the prospect of being able to make this available in Spain, Mr. Thomas remarks:—

"The object of calcining and reducing the ore to a matt at Huelva would of course be the application of the sulphur, entirely lost at Rio Tinto, to the manufacture of sulphuric acid and sulphate of soda.

"In England the ore is worth for the sulphur it contains £1. 10*s*. per ton, and the 120,000 tons we have supposed to be raised may therefore be valued at £180,000 for sulphur. At Huelva the value to be put upon it would be very much less than this, and would in a great measure be dependent on the fiscal arrangements of the government.

"In Spain salt is a government monopoly. The salt works are in the hands of private individuals, who are compelled to sell to the State all they make at 2½ reals per quintal, or 11*s*. 6*d* per ton; the latter retailing it to the public at 40 reals per quintal, or £9. 3*s*. 4*d*. per ton. Previous, then, to undertaking the manufacture of sulphate of soda, the government permission to establish "Salinas," and to make such salt as may be required, must be obtained. Were this granted, no difficulty would be encountered in selecting a suitable spot for works in the vicinity of Huelva, and I am of opinion that the manufacture of the products in question could be economically carried out there."

Such is the position of the mines of Rio Tinto, as described by Mr. Thomas. That a district of almost unbounded mineral wealth exists in this part of Spain is beyond all doubt; and it is equally clear, as Mr. Thomas says, that its present condition is, in this age of science and railways, a disgrace to the country that possesses it. But Spain is a country progressing in material resources at the present day faster than any other in Europe; and in a few years we may expect to see great changes.

THE *ANNALES DES MINES* ON THE PRESENT POSITION OF THE METALLURGY OF IRON IN ENGLAND.

Annales des Mines, ou Recueil de Mémoires sur l'Exploration des Mines, et sur les Sciences et les Arts qui s'y rapportent. Rédigées par les Ingéneurs des Mines, et publiées sous l'Autorisation du Ministre des Travaux Publics. Cinquième Serie. Tome XIX. 1861. Paris: Dunod, Quai des Augustins.

This famous periodical, by far the most renowned publication in the world connected with mining and metallurgy, has long been particularly celebrated for the descriptions which, from time to time, have appeared in its pages on the mines, mining appliances and machinery, and metallurgical processes of other countries. To a great degree this may be accounted for by the natural dearth of subjects available in a country so comparatively poor in mineral resources as France, particularly when compared with the supply of highly cultivated ability afforded by such a corps as the French *Ingéneurs des Mines*—a corps selected by competition from the choicest youth of France. But, to whatever cause it may be attributable, to the *Annales des Mines* is due the credit of being generally foremost in describing the mining and metallurgical processes in use in every part of Europe, being even not unfrequently beforehand with local engineers. In this country they have certainly managed to go ahead of Englishmen in describing many of our most important operations. Le Play was the first to give any complete description of our modes of copper-smelting, Combes was one of the earliest to teach Europe and our own engineers what extraordinary machines we possessed in the Cornish condensing engines, the details of whose duty had been previously laughed to scorn. Even in our own time, M. Moissenet has given by far the best, and indeed the only complete, description of the Cornish methods of tin dressing—a point of the greatest value at the present moment. The same author has also anticipated, by the few months, Dr. Percy's description of the Cornish methods of assaying in all essential particulars. We believe that at the present moment French engineers are examining the salt deposits of Cheshire; and to them we will also be probably indebted for the first comprehensive description of these little known but highly important sources of our national industry.

Consequently, in a periodical so celebrated for dealing successfully with the mining and metallurgical progress of other countries than its own, we naturally look with considerable interest on an elaborate paper contributed to it, by two eminent engineers especially commissioned by the French Minister of Public Works, on the present position of that great branch of industry upon which so much of our material prosperity and wealth depends.

The authors of the paper in question are Monsieur Gruner, Professor of Metallurgy at the Imperial School of Mines, Paris, and Monsieur Lan, occupying a similar position at the Mining School of Saint-Etienne. To enter into anything like a complete analysis of their elaborate memoir, which extends over two *livraisons* of the *Annales*, would exceed the space at our disposal; so, on the present occasion, we shall content ourselves by referring to a few topics of general interest, reserving a general analysis of the paper for another occasion. Coal, both in regard to cost and general fitness, being the basis of all iron industry, the paper commences with enquiries respecting that mineral.

Comparative Rents and Royalties payable on Coal in England and France.—In England the property in minerals belongs to the proprietors of the soil.* These they usually let or farm at certain royalties fixed at their

* We suppose that most of our readers are aware that in France, and generally on the continent, this is not the case. All mines are under the control of the State, which alone has the right of dealing with them, and fixes the royalties payable to itself and the owners of the soil—never exceeding 5 per cent on the net profits.

pleasure. These royalties, small originally, have gone on progressively increasing, and form at present one of the heaviest charges, particularly having regard to the prices of the coal. In the western part of the Dudley district, for instance, where competition is so keen, the royalties paid reach, in certain instances, to 2*s.* and 3*s.* per ton. The mean royalty paid in the Newcastle district is only about 6*d.* per ton; but, taking the whole of the great coal districts of England, we may assume a general average of from 6*d.* to 9*d.* per ton—or about 12 per cent. on the average selling price of say 5*s.* These are very much greater dues than are paid in France, where the royalty paid to the State has not, on an average, exceeded a limit of from 1*d.* to 1¾*d.* per ton. In some parts of France certainly these payments are as unequal as they are in England; and if in some parts of South Staffordshire 2*s.* or 3*s.* per ton is paid, the mines of Saint-Etienne paid, in 1858, about 8*d.* per ton to the proprietors of the soil, and 2¾*d.* per ton to the State, and some of the collieries of the department of *la Loire* as much as 5*d.* or 6*d.* to the State, and 9*d.* and 1*s.* to the proprietors of the soil—although, in considering this, it must be borne in mind that the selling price is precisely double in France.

But the measure of the greater burden borne by English colliery workers is not merely shown by the above figures, for experience shows that in England the royalties go on continually increasing, while in the department of *la Loire*, the heaviest burdened in France, they decrease with the depth to a certain limit. And besides the French *concessionnaires* are not merely tenants on a terminable lease, but absolute proprietors, subject to terms fixed by general laws, as long as they choose to continue the works. The system of terminable leases also leads to a grasping spirit of working and consequent waste, a system which evidently leads to a discount of the Future to the profit of the Present: thus in Staffordshire half the coal has been sacrificed, and at least a quarter is still lost there as well as in Scotland.

On the other hand, if the mines of England are burdened with heavier rents than those of France, they are free from the troublesome interference of the State, and the endless formalities which are required by the French mineral laws, which can only be thoroughly appreciated by those who have been subject to them. As the authors of this memoir justly say:—"*Il est vrai que si l'Etat ne fait rien, au moins il ne gêne pas les travaux des compagnies, comme trop souvent cela arrive en France.*" The existence of large properties, too, facilitates the construction of the local railways, which in France are impracticable without the intervention of the State.

Comparative price and increasing production and consumption of Coal in England and France.—The great advantage which the iron industry of England possesses over that of France is the low price of coal, averaging about 5*s.* per ton, while in France it averages exactly double, or 10*s.* per ton. But the real difference is even still greater than is shown by these figures, for the English price applies to *large* or *screened* coal, while the French price applies to the average of the whole. The difference was not so great twenty-five or thirty years ago, or even eight or ten years ago; and everything tends to show that the difference of price in the two countries has now reached a maximum which may be expected to decrease.

The coal-fields of France, with the exception of those of the departments of the *Nord* and *la Vendée*, being situated in the centre of the country, were until recently inaccessible to distant consumers. Thanks to railways and canals this is now modified; but still the disadvantages of France must in this respect always be considerable. Yet, within the last twenty years the French colliery industry has developed itself comparatively more rapidly than in England: in that country the production and consumption have both trebled since 1830, while in France, within the same period, the

production has increased in the ratio of 1 to 4½, and the consumption in that of 1 to 5½. From 1831 to 1833 the total quantity of combustible mineral furnished annually only reached a mean of from 1,500,000 tons to 1,600,000 tons, and the consumption to 2,500,000 tons; while in 1859 the production of France had augmented to 7,500,000 tons, and the consumption to 13,500,000 tons. This result is encouraging; and if the French production has not kept pace with the consumption, it may be expected that the completion of canals, lines of railways, with the reduction of duties and tolls, will contribute more than any thing else to make up the deficiency.

On the nature of the various Coals.—This is a very valuable portion of the memoir, particularly as it gives the result of the experiments made at the French dock-yards on the various qualities of English and French coals. We may refer to this on another occasion.

The fifth chapter of the memoir brings us to the Iron Ores, and the consideration of the comparative cost and capabilities of those of England and France. The description of the English iron ores, their localities and modes of occurrence, statistics, and comparative capabilities, is very complete, but naturally presents no particular feature not before known to those acquainted with the subject. The authors class these ores into the five following divisions:—

1. Ores of the coal measures, including the argillaceous iron-stone and the black-band.
2. The red hæmatites (red ores) of Lancashire and Cumberland, worked in the carboniferous limestone.
3. The oolitic ores of Cleveland, and those of the secondary strata of Northampton, Buckingham, Oxford, &c.
4. The brown hæmatites and spathic ores found scattered in Cornwall, Devonshire, Somersetshire, and parts of Wales, Cumberland and Northumberland, generally in comparatively small quantities.
5. The ore found at Froghall, in North Staffordshire, in the millstone-grit, and which is found to pass, at points, into the ordinary clay iron-stones, and even black-bands.

Comparative price of English and French iron ores.—In this respect England is at as decided a disadvantage as France is in the case of coals. France is richer in iron ores than England, the greater part of the large iron-works of the former country incurring a much less cost per ton for the ores necessary to produce a ton of pig-iron than makers in the latter country. The authors here take exception to the figures given in Mr. Hunt's "Mineral Statistics" for 1858, as to the cost of iron ores, particularly those of the coal-measures: "*Nous croyons qu'il y a positivement erreur dans les chiffres officiels, ou que les prix mentionnés ne comprennent pas la redevance payée au propriétaire du sol.*" Passing over this point we shall conclude this abstract with the following observations of the authors on the comparative cost of the ores to the English and French iron makers:—

"If therefore in England, in one special district, as that of Cleveland, the cost of the ore per ton of pig-iron does not exceed from 14*s*. 6*d*. to 16*s*. 6*d*., there are also works in France specially favoured, like those of *la Moselle*, where the cost of the ore per ton of pig-iron does not exceed 12*s*. 6*d*. But leaving out of the question this special case, it is undoubted that in England there is in general consumed, per ton of pig-iron, ores to the value of from 29*s*. to 33*s*. 6*d*.; while in France the value does not exceed from 21*s*. to 25*s*.; thus showing an advantage to the latter country, in the matter of ores, of about 8*s*. per ton of pig-iron, and from 2*s*. 6*d*. to 3*s*. 3*d*. per ton of ore.

"It is clear that the great advantage of the English maker is really in the low price of coal, and that in the matter of ores the advantage rests with France. In this respect France is in about the same position as Belgium; but like the English the Belgians have the advantage of cheaper coal."

THE BLOW-PIPE VADE-MECUM.

The Blow-pipe Characters of Minerals. Deduced from the original observations of AQUILLA SMITH, M.D., M.R.I.A., Vice-President of the King and Queen's College of Physicians. Alphabetically arranged and edited by the Rev. SAMUEL HAUGHTON, M.A., F.R.S., President of the Geological Society of Dublin; and ROBERT H. SCOTT, M.A., Secretary of the Geological Society of Dublin. London: Williams and Norgate.

WITHIN the last few years several publications have appeared in this country on the blow-pipe, mostly either translations of German works, or at least principally derived from German sources. One of the most useful of these has been published by Messrs. Williams and Norgate—that of Mr. Blanford, founded on Scheerer.

The present work, however, occupies a different position from any of these, for it is *original*. This originality is in some cases not without its drawbacks, for it deprives us of the advantages derived from previous investigations; still, on the whole, it gives a value to the work which no mere compilation can possess, and undoubtedly renders it, as the editors say, "a most valuable addition to British Blow-pipe Literature."

The instructions for the use of the instrument, and the various supports and re-agents, are simple, and seem in all cases to be derived from original observations. Some of these are rather old-fashioned, and are probably scarcely equal in effect to those described in the more recent German works; but as in this book the blow-pipe is only suggested to be used for testing minerals, they will be found, we do not doubt, sufficient for all practical purposes. In truth, this volume is as much a treatise on minerals, from a blow-pipe point of view, as on the blow-pipe itself.

As indicated by the title, the minerals are arranged alphabetically as in Mr. Bristow's "Glossary." The names of the editors are a sufficient guarantee that this is done correctly, and as it should be; and we have consequently much pleasure in recommending this volume to practical mineralogists. Coupled with Mr. Bristow's "Glossary," to which it forms an excellent companion, both being alphabetically arranged, no one need be long at a loss to recognise any mineral species.

MR. HULL ON THE COAL FIELDS OF GREAT BRITAIN.

The Coal Fields of Great Britain; their History, Structure, and Resources, with Notices of the Coal Fields of other parts of the World. By EDWARD HULL, B.A., of the Geological Survey of Great Britain, Fellow of the Geological Society of London. With Maps and Illustrations. Second Edition, revised and enlarged. London: Edward Stanford, Charing Cross.

THE popularity of this book is in itself the best test of its value. A work on such a subject, which rapidly reaches a second edition, must be possessed of undoubted intrinsic value, and meet a recognised want. The want in this case was for a popular, yet sound, description of our coal fields, written by one well acquainted with the subject, and capable of conveying his knowledge to his readers in a popular style.

Mr. Hull's work has now reached a position which renders any detailed criticism unnecessary. It has become a standard book, which must be on the bookshelves of every one interested in any degree in the coal-industry of this country. This second edition contains much new matter, and an excellent Map of the British Coal Fields, shaded so as to show the depths at which the mineral probably lies.

Notes, Queries and Correspondence.

[WE need scarcely say that we cannot hold ourselves responsible for the facts or opinions of our correspondents; although we shall make it a point to endeavour to exclude those which are obviously inaccurate or fallacious, as far as is consistent with our wish to encourage the freest discussion. It may be convenient, on the present occasion, to remind our practical readers, once for all, that the widest liberty of discussion can be enjoyed without having recourse to personalities. It is quite possible for persons to differ as widely as possible on technical or scientific subjects, and to express those differences with the greatest frankness, and yet at the same time to entertain sentiments of the highest mutual general consideration and personal regard.]

DR. PERCY'S "METALLURGY."

SIR,—I have waited long and anxiously for Dr. Percy's book, believing from the position he holds as lecturer on metallurgy at the Government School of Mines, and having consequently the best opportunity for receiving information and testing projects and products connected with the metallurgical arts, that, when the book did appear, full justice would be done to the subject. But, whether from the length of time that has intervened between the promise and its fulfilment, my expectations had become too high, or that the Doctor has not done all he could and should have done under the circumstances, I am unable to say; but I must express my disappointment with certain parts of the book, while I am constrained to say that it is the best work on technical metallurgy in the English language. On some of the practical parts, particularly in reference to the smelting of the ore, it is defective, and shews more than anything can, that if metallurgy is to be studied properly, it must be done at the works where the practical operations are conducted.

Dr. Percy has made free use of all the information that has been printed before on the subjects he treats of, without giving (at least in my opinion) that free acknowledgment which we would have expected from a man of his position. Where the matter could not be reduced to the Doctor's standard, it has been generally treated as spurious and "roasted" at a very high temperature, except, indeed, where a connection can be traced with the Hafod Works, where all is acknowledged to be good, the Doctor having met with great kindness from the proprietors and others at these works in 1848. We would merely ask, in passing, if the Doctor did not meet with equal openness and kindness in any other works? This partiality, and the tone in which other writers are referred to, are marked defects in the book, and this spirit, as I think, will be more apparent to the practical man than to the general reader.

Some of the Doctor's strictures are aimed against practical observations made in circumstances that he has not had any opportunity of either proving or disproving, except upon certain theoretical considerations, or deductions from the results of small crucible experiments. These I am constrained to notice somewhat in detail. In one or two cases, however, the Doctor shews that *à priori* reasoning is not to be taken as evidence to disprove a positive result. For instance, after copying analyses of *blister copper* given by Mr. Napier in his papers on Copper Smelting in the *Phil. Mag.* for 1852, he says:—

"Mr. Napier remarks that the oxygen existed in the state of dioxide of copper dissolved in the metallic copper, a result which *a priori* would hardly have been anticipated, but that sulphur and dioxide of copper may co-exist in metallic copper has already been demonstrated at page 264."

This should have taught Dr. Percy to have been more charitable in his strictures than he has been in cases where he has not had the matter to

test in his laboratory at the School of Mines. Mr. Napier, in the paper already referred to, when describing the calcination of the ores, and endeavouring to find out the reaction that takes place within the furnace during that operation, carried out a series of experiments, one set of which is disparagingly referred to by Dr. Percy with evident delight,

"Mr. Napier has published the following statements relating to the process of calcination, which, in my judgment, cannot be accepted. 'We took,' writes Mr. Napier, 'a charge of Cuba ore and calcined during twelve hours, and tried every hour, gave the following results, *(sic.)*'" I could not believe till I turned up Mr. Napier's paper that the Dr. could add *(sic)* to a mis-quotation; yet such is a fact. But to proceed with the Doctor's quotation :—

"COMPOSITION OF THE ORE."

	When put into Furnace.	In 1 hour.	In 2 hours.	In 3 hours.	In 4 hours.	In 5 hours.	In 6 hours.	In 7 hours.	In 8 hours.	In 9 hours.	In 10 hours.	In 11 hours.	In 12 hones.
Copper.........	12·3	13·0	12·2	12·2	13·0	12·2	13·8	12·6	12·6	12·5	13·2	13·8	12.2
Iron	32·7	30·0	24·4	32 8	28.7	31·3	33·6	30·6	30·0	27·6	24·3	40·3	27 0
Sulphur	31·1	28·3	23·6	18·6	29·2	24·4	12·2	18·1	20·0	15·9	18·8	17 5	16·2
Silica	24·0	28·0	32.0	28·0	26·0	28·0	34 8	32·0	30·0	30·8	33·0	21·0	40 0
	100·1	99·3	92·2	91·6	96·9	95·9	94·4	93·3	92·6	86·8	89·3	92·6	95·4

"Mr. Napier remarks—'When we take into consideration the several amounts of sulphur, we observe what appears very anomalous, that there is less sulphur at the end of six hours than after twelve. It may be asked where the sulphur has gone—whence comes it again? In all our experiments this intermitting action of the sulphur is exhibited.' He then presents an explanation of this alleged action. Now, in another experiment, the results of which are given in the very same paper as that from which the preceding extracts were taken, Mr. Napier found that the sulphur gradually diminished from the commencement to the end of the calcination, which was continued during forty-four hours. But we hardly seem to require the aid of experiment to demonstrate the fallacy of the 'intermitting action.' It is certain that during the entire period of calcination, sulphur, especially in the state of sulphurous acid, issues in a continuous current from the furnace; and as this sulphur must be derived from the ore, except the comparatively minute and quite insignificant amount which may be evolved from the fuel, it follows necessarily that its proportion in the ore must continually decrease from the beginning to the end of the process. In order that Mr. Napier's results should be of any value, it is essential that the ore operated upon should be absolutely homogeneous throughout, and that every portion withdrawn from the furnace for the purpose of analysis should be a *perfect sample;* in other words, a specimen which, for the time being, correctly represents the average composition of the ore; but it must obviously be extremely difficult, especially when operating upon large quantities of ore in furnaces, to insure this indispensable condition; and it may be proved from the very data which led Mr. Napier to admit the 'intermitting action' in question, that the successive portions of ore which he extracted from the calcining furnace, and afterwards analysed, could not have been samples."

This long extract, with its large expenditure of logic to prove certain observed facts to be erroneous, requires a careful examination, as I consider this mode of treating the labour of others in the field of practical science is not only unfair, but hurtful to the progress of that very enquiry which Dr. Percy's book is intended to advance. If the Dr. will set himself up as judge, he should be careful of the relevancy of his evidence, and sift it less partially. As the extract from Mr. Napier's paper is stopped at the part where an explanation of the results is offered, because it is unintelligible to the Dr., I will endeavour to give an explanation of the matter, which I do the more willingly, because neither Mr. Napier originally, nor the Dr. at present, have appreciated the value of the results of the experiments, and the direction for improvement which they point out. The hearth of the calcining furnace over which the ore was spread measured about 18 feet by 12 feet; the fire being at one end, there would consequently be different degrees of temperature over the hearth where the ore is spread; and from one part of this hearth Mr. Napier took out a specimen, or portion of the ore every hour, and tested it. In every series of experiments he found a less or more irregularity in the sulphur present. After making himself fully confident of the fact, Mr. Napier offers as an explanation, that from the sluggishness of the draught in these calciners, arising from reasons which he gives, and the paucity of oxygenized air present, the sulphur is sublimed from the ore at one part of the hearth, and absorbed by another portion of the ore (under certain conditions) at another part of the hearth; thus giving rise to the irregularity in the quantity of sulphur found in the ore at one part of the hearth at different periods of the process, as shewn in the above table. Unfortunately, Mr. Napier called this irregularity "intermittent," a term which may be admitted to be inaccurate, and which the Doctor makes the most of. While I willingly take the Doctor as an authority on positive results he has himself obtained, I am not inclined to take his *dictum*, without proof, against experimental facts. Mr. Napier's results, I think, point out a radical defect in the structure of the present calcining furnaces, which do not allow a ready and *immediate* escape of the sulphur whenever it is set free from the ore, whether as sulphur or sulphurous acid. In proof of this opinion I may refer to a pyrites burner, in which an ore of 50 per cent. of sulphur gives off 45 per cent. of this sulphur in less time than the copper ore-calcining furnaces will burn off one-fourth of this quantity of sulphur. Dr. Percy would have done better service to metallurgy had he pointed out some such practical applications of Mr. Napier's experiments, rather than have allowed himself to be led into disparaging strictures, founded on insufficient data.

After reading these strictures, and perceiving the spirit they indicated, I hastened on to that part of the book where improvements in copper smelting were reviewed, to see in what light Mr. Napier's process for smelting copper ores was examined, and I am sorry to see that the Dr. seems to view it through an atmosphere of copper smoke as dense as the Hafod Works could evolve, which causes him to withhold his judgment as a chemist, rather than commit himself in an opinion that might do justice to a worker in the same field, or give offence in certain quarters, or violate long-cherished partialities. In proof that the book is swayed by some influence on this head when describing Mr. Napier's process, we quote what the Dr. says:—

"The sulphate of soda being put into the furnace in admixture with coal, becomes reduced to sulphide of sodium; which is uniformly diffused through the *coarse-metal*, probably in a state of chemical combination. When the pigs are thrown into water the sulphide of sodium slowly dissolves, and the whole mass is disintegrated and reduced to impalpable powder. Now, as the sulphides of tin, antimony, and arsenic are strong sulphur acids, and as sulphide of sodium is a strong sulphur base, *was it conceived* [the italics are mine] that, in the event of any of these metals

present in the ores, they would be dissolved out during the disinte-
n, and subsequent washing, in the form of solublesulpho-salts?" Why
, "it was conceived?" The Doctor is certainly qualified, as a chemist,
whether a strong boiling solution of sulphide of sodium will dissolve
ony, tin, and arsenic, if present in the ore; and if so, frankly admit
he process was right *in principle*; and also as openly state any prac-
defects, if he knew any; although these latter should be founded on
r data, not on mere reports from Swansea. The Doctor certainly does
the possibility of some of these metals being dissolved out, for he

examined a solution which had been obtained in this manner, and it
nly contained antimony, as might have been anticipated if that metal
een present in the ore. In the course of practice it was, I believe,
that the separation of these metals was far from complete, and from
ause or other this new process of copper smelting was speedily
loned, and the ancient method resumed at the same works." I have
sire to enter here into the circumstances which led to the discon-
nce of this process in England, nor will I enter into the evidence that
hin my power of its capabilities of making copper of the best quality
from these metals referred to, and made, too, from ores that originally
ined them all in considerable quantity. If the copper trade had been
pen as other trades, that process, or some modification embracing the
principles, would have been generally adopted for our Cornish ores,
for purity of metal and economy in obtaining it. I will merely here
, in the interest of truth and justice, that the statement that the new
ss was speedily abandoned and the ancient method resumed, is a
lete inaccuracy; and in making it the Doctor has evidently been led
y by incorrect and probably interestedly incorrect information. The
of the case are these:—Mr. Napier's process was wrought in the
y Works for between three and four years, when the works were put
r a new manager, who, to save the expense of the soda used in
er's process, crushed the *coarse metal* into powder, under rollers
pan mill, calcined this powder, and then fused along with it
Australian or other ores having little or no sulphur, for which
ss a patent was taken out by the manager and chemist conjointly,
n as Trueman and Cameron's patent. This process was wrought
rithin a few months of the stoppage of the works, when a modification
introduced which is not patented nor referred to in Dr. Percy's book,
t *no time* was the *ancient method* resumed. That no scrap of informa-
be lost without being put into the balance in favour of Dr. Percy's
ds, it is stated that—

The works were purchased a few years ago by Messrs. Williams and
m, who, it is reported, extracted from the furnace-bottoms and other
riferous materials on the premises a large quantity of copper in excess
e estimated amount; but whether this report be correct or not I am
le to state. It certainly is not an improbable one." Not the least im-
able, considering that the estimates were made by the purchaser's agents.
reason that such a piece of information is volunteered in a book of
high character is difficult to account for. We will not suggest motives
r. Percy's informants; but should the book reach another edition, which
re no doubt it will, I would earnestly and sincerely suggest that the
or confine his statements to matters depending more on his own and
tant's labours in the School of Mines, and trust less to interested state-
ts.

AN OLD COPPER SMELTER.

OXLAND'S PROCESS AT EAST POOL.

SIR,—In No. 1 of the " Mining and Smelting Magazine" you give a very interesting description of the process employed at the "East Pool Mine" for separating wolfram from tin, but which you remark is a very wasteful process indeed. When the whole of the operation detailed by you is considered chemically, it is not at all strange that such a large loss of tin should result, from the fact that most of the commercial soda-ash contains a considerable quantity of caustic soda, which, when brought in contact with oxide of tin, at a red heat, will combine and form stannate of soda, which is soluble in water, and consequently would be dissolved and washed away in the after stamping and washing.

The quantity of tin lost would depend on the per centage of caustic soda contained in the soda-ash. Yours, &c.,

CHEMIST.

CANNEL AND ORDINARY COAL.

SIR,—I should be glad if any of your readers would kindly furnish particulars of any bed of cannel passing into ordinary coal, or into any other substance, when traced in particular directions. It would be important to note whether the character of the roof or floor changed at the same time, or whether any local circumstance was supposed to produce or influence the change. X. Z.

The Government School of Mines. Museum of Practical Geology.

THE following are the arrangements of the courses of lectures, to be commenced during the month of February, at the Government School of Mines. On the 10th Professor Ramsay will commence a series of thirty lectures on Geology. The first part of this course will embrace:—The agencies now changing and modifying the physical conditions of the earth;—the mineral substances entering into the composition of rocks, with an explanation of geological terms, &c.;—the origin of stratified rocks;—the nature of denudation and alteration of the earth's surfaces by aqueous agencies;—theory of the origin of salt lakes, and the elevation and depression of land;—coral reefs;—earthquake and volcanic phenomena;—theory of volcanoes, and the analogies between existing volcanoes and those of past geological periods. The mode of occurrence of organic substances in rocks, with a consideration of the process of fossilization, will conclude this division of the subject. These lectures will be delivered on Mondays, Tuesdays, Wednesdays, Thursdays, at 1 o'clock. A course of thirty lectures on Applied Mechanics will be delivered by Professor Willis, also commencing on the 10th. This subject will include the principles of Mechanics, with their practical applications:—friction;—elasticity;—strength of materials, &c.;—regulators of velocity and dynamometers;—steam engines;—and other moving powers;—general construction, arrangement, and framing of machines, with a description of their different parts;—machine tools for working in wood, metal, &c., and various other machines for direct use. These lectures will be delivered at 12 o'clock every day in the week but Saturdays. The lectures to Working Men will be continued on the 17th of February by Dr. Tyndall, who will then commence a course on the subject of Heat. Dr. Tyndall will also deliver a series of evening lectures on Light, commencing on the 27th. When we remember the admirable and complete manner in which all Dr. Tyndall's lectures (especially those which he has already delivered on light and heat) have been illustrated, we cannot doubt but that they will be largely attended, and add to that success which has hitherto rewarded the educational efforts of the scientific staff of the Government School of Mines.

Mining, Quarrying, and Metallurgical Intelligence.

The *Colliery Guardian* gives, in its impression of the 18th January, a very important return of the total shipments of coal from ports on the coasts of England and Scotland during the past year. It is not pretended that these returns are strictly accurate, but for the greater part they are derived from the admirable list of exports originated by the late Mr. Browne, of Newcastle, whose accuracy, as far as they go, will not be questioned. Browne's list, however, omits several small ports which in the aggregate export a considerable quantity of coal, and for the figures relating to these reference has been made to Mr. Hunt's "Mineral Statistics" for 1860, and an approximating total for the past year based upon the information derived from thence. These ports are Bristol and Gloucester, Workington, Neath, Port-Talbot, Porth-Cawl, Milford, Chester, Preston, Runcorn, Fleetwood, Lancaster, Leith, Kircaldy, Dundee, and Aberdeen. The shipments being mostly coastwise, the quantity sent from these ports is estimated at 1,250,000 tons, which is a trifle less than Mr. Hunt's estimate for 1860. Last year, too, about 80,000 tons were shipped from ports distant from coal-fields, and about 100,000 tons of patent fuel were put on board ship for exportation.

The conclusion arrived at after casting up the columns is, that upwards of *nineteen millions* of tons of coals have been shipped from the coal-fields of England and Scotland during the year 1861. First of all, there are upwards of 7,000,000 tons exported beyond the seas, and nearly 10,000,000 tons coastwise, according to the figures derived from the file of Browne's list. To these may be added 1,250,000 tons from various ports enumerated above; 85,000 tons from ports distant from the coal-fields, as London, Portsmouth, Gainsborough, Rochester, Boston, and one or two others; 714,206 tons in the shape of coke and culm, and at least 90,000 tons of patent fuel. The exact figures are 19,161,615. A comparison with previous years is afforded by the following figures:—

			Tons.
Total exportation,	1861	... ...	19,161,615
" "	1860	... ...	18,159,488
" "	1859	... ...	17,218,972

showing an increase has taken place in shipments of coal at the rate of about 1,000,000 tons per year.

The following is an account of the quantity of coal shipped to London during the year, and included in the figures representing the exportation coastwise:—

	Tons.		Tons.
Newcastle	1,283,184	Blyth	46,326
Sunderland	1,057,403	Liverpool	333
Seaham	179,251	Yorkshire	30,279
Middlesbro'	5,717	Wales	124,843
The Hartlepools ...	719,948	Scotland	21,852

From various ports there have also been imported into the London market, 14,107 tons of duff; 17,751 tons of small coal; 1,281 tons of culm; and 16,687 tons of cinders. Total imports of seaborne coal into the London market, 3,567,002 tons.

The following is an account of the number of Blast Furnaces in Great Britain, and their yield of iron, in 1861:—

	No. of Furnaces in Blast.	Make of each Furnace per week. Tons.	Total Yield per Annum. Tons.
Staffordshire	131	135	919,620
Shropshire	22	130	148,720
Forest of Dean	3	150	23,400
Northumberland, Durham and Cleveland ...	58	175	527,800
West Riding of Yorkshire	25	80	104,400
Lancashire and Cumberland	14	230	167,440
Northamptonshire	3	175	27,300
Wiltshire...	2	135	14,040
Derbyshire	22	100	114,400
Total—England ...	280		2,046,720
South Wales	124	145	934,960
North Wales	5	90	23,400
Scotland	124	150	967,200
Total—Great Britain ...	533		3,972,280

CORNWALL AND DEVON.

St. Ives and Lelant Districts.—In our last number we gave a short description of the St. Just District, and of some of the mines in it. The St. Ives and Lelant mines do not present such striking features, but still the district is one of the most picturesque in Cornwall. In approaching it from the Hayle side, the landscape that opens presents an unusual combination of the sublime and the beautiful. The estuary forms a beautiful lake in the foreground, fringed with the rich woods of Trevethoe, (the ancient seat of the Pread-Tyringham family), above which rise the rugged summits of Trencrom and Trink Hills. On the right lies Lelant "town," beyond which stretch the towans or sand-hills, and the magnificent sea and coast forming St. Ives Bay.

This district, whose produce is essentially tin, is most ancient, and has on the whole been a most prosperous one. The mines are principally in the granite, in the upper parts of the parish, which is generally rough, and worth little for any other purpose. One of the most important and successful concerns in this district is the *Providence Mines*, under the pursership of Mr. Higgs, of Penzance. It was worked for many years before any profits were made; but of late years it has been giving very regular dividends—lately £1 per share (1,120) per quarter. The tin which generally occurs here, as in many other mines in the district, is rich bunches or "carbonas." The mine has every indication of great permanence, and as new and valuable ground is being now opened up, a long course of prosperity may safely be expected.

East Providence adjoins this on the east, and is worked on the same lodes. Operations have now been going on for about five years; but hitherto without success. The workings, however, are now being prosecuted very close to the Providence Mines boundary, on a lode which has been rich in that mine not very far off. As the country here is of a kindly nature, and the lode produces work for tin, great expectations are entertained of success here.

Wheal Margaret and *Trelyon Consols* are also in the neighbourhood of Providence Mines, and are promising concerns. To the west, further in the granite, lies *Worvas Downs*, a very remarkable piece of ground as to the mode in which the tin occurs.

Wheal Margaret, West Margaret, Durlo, Wheal Reeth, Wheal Kitty, Trencrom, Wheal Mary, Lelant Consols, and Praed Consols lie in the southern part of Lelant parish. *Wheal Margaret*, under the management of Captain Treweeke, is an old-established and highly respectable mine,

which keeps up its dividends well, and has every prospect of permanency, although some of the levels are extended up to the eastern boundary. *West Margaret* lies to the west of this. *Wheal Reeth* is a great old mine recently re-opened at a very heavy cost, which, however, is now nearly at an end. The levels going east of the cross-course are looking well and opening out good tin ground, which must give increased returns; while the cross-cut south to Praed's lode is being pushed on vigorously. If this lode should cut rich, which there is every reason to expect, this old mine may be expected to rival its former productiveness. The number of shares is 240. The parties connected with this mine are of the highest respectability.

Wheal Kitty is at present in a most promising position, especially in the southern workings. The Margaret levels are near the boundary, with the ends good. There is no reason why these lodes should not give good profits in Kitty, when an adequate amount of ground has been opened up on them.

Trencrom is also a promising mine; and all the necessary machinery and erections are completed to enable the returns to be made to advantage. The new north lode is opening well. The tin-stuff here is peculiar, being unusually fine in the grain; so much so that it is stated that the stamps generally turn out more than is estimated from the samples—a very satisfactory result.

Wheal Mary, adjoining Margaret, is another fine old-fashioned mine, in 100 shares, not often seen in the "market." This is a very long-established concern, having exhausted the term of several leases, and given immense profits. The levels were extended so far east of the original workings that new count-houses and offices had to be erected; but lately the mine has not been so profitable, as a hard bar of unsettled ground had to be passed through eastward. This is now passed through, and the lode here is now improving. Operations are also about to be commenced on the rich Margaret "Carn Moor" and "Foul" lodes, the ends of which are extended up to the boundary of this selt.

Lelant Consols is still poor, but is said to be looking better. It is an excellent example of the perseverance of local mining in this district, for it has now been under trial for nearly twenty years without success. If it should come, it will most certainly be well deserved. *Praed Consols* is only working on a limited scale; but tin has been recently cut, which, if it holds down, may lead to good results.

Of course this district suffers, like all other tin districts, from the fall in the prices of the metal. But still it is a great old district, which has been worked as long as our island has been known in history, and will probably be still worked when our coal-fields are exhausted. The valleys are full of records of past streaming, and there are also remains of "Jew Houses," or ancient tin-smelting works. In one case the remains of the charcoal used in the operation, and also a considerable quantity of metallic tin, in the form of small lumps like large shot, were found amongst the *débris*; and a small block of tin was found not far off.

In the St. Ives district, *St. Ives Consols* is of course the principal mine, although it has lately rather fallen off. There can be no doubt, however, that it will soon again recover its old *status*, for it is a sett of enormous resources—abounding particularly in "carbonas." *Rosewall Hill and Ransom United* adjoins this on the west, and is now looking very well. Some suspect this mine to be the coming prize of the present year; and it is an undoubted fact that some quantity of valuable tin ground is being opened up. *St. Ives Wheal Allen*, also close adjoining, is likewise a very promising concern.

WALES AND THE BORDERS.

CARDIGANSHIRE.—The following is the return of the quantities of metallic ores—lead, copper and zinc—shipped from the port of Aberystwith from the 1st January to the 31st December, 1861.

LEAD ORES.

	Tons.	Cwt.		Tons.	Cwt.
Lisburne Mines... ...	3,121	14	Bronfloyd	86	13
Cwm-Ystwith	1,395	10	Cardigan Consols ...	69	2
East Darren	1,085	5	Esgair-y-mwyn ...	62	5
Cwn Erfin	760	8	Allt-y-crib	56	8
Goginan	409	17	Rheidol United ...	40	13
Cefu-Crwym	289	1	Bwlch Consols ...	40	0
Nanteos and Penrhew ...	147	2	Nant-y-cria	25	17
South Darren	117	12	Gro-gwynion ...	165	6
Gellau-rheiron ...	90	0	Sundry mines ...	156	0
			Total ...	8,118	13

COPPER ORES.

	Tons.	Cwt.		Tons.	Cwt.
Cardigan Consols	41	2	Caradoc...	6	7
South Daren	26	10			
			Total ...	73	19

BLENDE.

	Tons.	cwt.
Lisburne Mines	63	0
Befn-brwyno	42	0
Cwm-ystwith	84	0
Rheidol United	227	0
Nant-y-cria	275	0
Total ...	691	10

This, we believe, comprises all the exports from the Cardigan mines, except 67 tons 5 cwt. shipped at Aberayron from the Llanfair mines. Among all these mines, the first four in the list—Lisburne mines, Cwmystwith, East Darren, and Cwm-erfin are alone working to a profit.

We referred last month to the unfortunate result of most of the mining trials in Cardiganshire, during the last twenty years, except those conducted under the management of Messrs. Taylor. Besides those under the management of this eminent firm, there are, however, others which are being prosecuted with *bonâ fide* intentions, and which promise good results. Among these we may mention those under the management of Mr. Murchison and Mr. W. Spooner. *Rheidol United* and *Eaglebrook* are being wrought quietly, but still with miner-like vigour. *East Darren* is opening out an excellent piece of ore ground in the 20-fathom level west, with backs continually increasing. *South Darren* is opening out very favourably. The 80 west is worth 10 cwts.; 80 east, 9 cwts., 70 east, 1 ton; and 20 west, 12 cwts. of lead and 1 ton of copper ore per fathom. The lead ore realizes upwards of £16 per ton even at present depressed prices. The mine adjoins East Darren and Cwm Erfru, two good dividend mines. *Allt-y-crib* is being extended from the old washings on a lode producing one ton of copper ore per fathom. *Bwlch Consols* is opening out a comparatively new mine, and is rapidly increasing its reserves of ore. *Car-*

digan Consols and *Nanteos and Penrhiw*—mines in Mr. Murchison's office—seem only to require a proper outlay of capital to make them substantial paying concerns. Since we have known the district—about eighteen years—the mines have always been held in the highest estimation by those capable of forming the best judgment from a long experience; but, although worked off and on for all that period, they have yet failed to yield any substantial results; entirely, we believe, from the want of sufficient capital.

Indeed, in this respect—the necessity of having ample capital—the Cardiganshire mines occupy a position not usually understood. Of any metallic mining district in the kingdom, this, above all others, requires the application of abundant capital. In the majority of instances, even in the cases of the most profitable mines, the lead ore occurs considerably disseminated among ganguey matters; and consequently a considerable field of machinery is required to return it. Here it is not as in the limestone districts of North Wales, where the ore occurs comparatively solid and clean, and where the dressing is the simplest possible operation. The operations of dressing in Cardiganshire are costly and complicated—more nearly allied to those pursued in tin-dressing in Cornwall than any other. The mines are certainly worked by water power, and the hilly nature of the country gives considerable opportunity for adit levels; but this use of water power itself involves generally a heavier preliminary outlay of capital than the erection of steam power would, except in some exceptional cases where a considerable stream is immediately available. Extensive pounds and long leats have to be made, so as to insure a continuous supply throughout the dry season; and if this is not done effectually the mine will be idle a large proportion of its time, and effectual working be out of the question.

Hence, in cases where prospectuses promise *immediate* profits in this district, caution should be observed. It is not the characteristic of the district to afford rich and pure bunches of ore, from which profits can be made under the most disadvantageous circumstances. The ore occurs with considerable regularity, but much mixed up, and can rarely if ever be wrought with profit unless after being laid open on a large scale, with proper reserves. The smaller mines in the district do not do this—and hence they necessarily fail.

In this district, as throughout Wales generally, the mines are worked on the limited liability system. The difficulty of the application of this system to mining is, that the nominal capital is frequently fixed too low, and when this is spent, as no more can be called up, the concern is brought to a dead lock. This fixing of a low amount of nominal capital is a great mistake. The nominal capital, under the limited liability system, is not intended to be fixed exactly at the estimated amount required; it is intended rather as a limit of the possible liability of the shareholders, and hence should be fixed far above the estimate. If this had been done in the case of some Cardiganshire companies, much subsequent difficulty would have been spared. The fault rests, we think, rather with the public than the managers. If a large nominal capital is fixed, they are scared from the undertaking—just as if fixing this nominal capital as a possible limit, beyond which liability cannot extend, necessarily implied its being immediately called up and expended.

When companies get into this dead-lock of having called up all their capital, great difficulty is generally met with in devising means for procuring the additional amount necessary. In the case of Nanteos and Penrhiw a new method has been adopted. In this mine 472 shares have been forfeited; and these the directors propose issuing at £3 each, payable by instalments; this £3 to be returned out of the first profits, after which the shares will still rank equally, for all purposes, with the other shares. This seems a very fair proposition in the interest of all parties, and will probably be followed in the case of other concerns.

South Wales.—The authorities of two or three of the principal shipping ports of South Wales have just issued their official returns for the year 1861; and although the statistics for Cardiff (the principal port of export both for coal and iron) show a slight decrease as compared with the year 1860, yet we have reason to congratulate ourselves that, upon the whole, a very steady and satisfactory business has been done, and that the returns do not exhibit such a general depression of trade as some alarmists wished to make out The latter half of the year 1860 was a very extaordinary one, the shipments of coal being more active and brisk than ever before experienced in the history of the district; and this fact should be taken into consideration when looking at the general state of trade for the past year. During the past month of December Cardiff exported 92,447 tons of coal, and 8,321 tons of iron; whilst for the month of December, 1860, there were exported 93,906 tons of coal, and 10,860 tons of iron; and in 1859 103,089 tons of coal, and 4,781 tons of iron. The exports to foreign parts for the past year of 1861 were 1,123,657 tons of coal, and 132,493 tons of iron; for 1860, 1,142,366 tons of coal, and 169,467 tons of iron; and for 1859, 968,187 tons of coal, and 182,827 tons of iron. This is exclusive of the shipments coastwise, so that the total export of coal from the port of Cardiff for 1861 may be stated to be about *two millions* of tons, and about 200,000 tons of iron. The official returns for the port of Newport have not yet appeared, but we are in a position to state that there is not a very serious falling off in the returns, although undoubtedly Newport has been the most to suffer consequent upon the general depression of trade. The returns of Swansea are published in another form, but they equally prove the prosperity of the port during the past year as compared with that of the predecessor. From the statistics before us it appears that the receipts for the month of December last were £1,126. 8*s*. 0½*d*., as compared with £1,106. 19*s*. 0½*d*. received during the corresponding month of 1860. The number of vessels entering the port during the month was 390, as compared with 387 during December, 1860. The total trade for the year ending 31st December, 1861, was as follows:—Number of vessels 5,700, with a registered tonnage of 620,151, and the total shipping rates received £14,482. 3*s*. 3*d*. The trade of 1860 was 4,891 vessels, with a registered tonnage of 532,355 tons, and the rates received were £13,419. 2*s*. 7*d*., or an increase upon the year of 809 vessels, 87,796 tons, and £1,063. 0*s*. 8*d*. tolls. These returns do not include the very large number of vessels which arrive in the port in ballast for cargoes, but from a computation which has been made, we believe we shall not be far wrong in stating that upwards of a million tons of coal and general merchandise has been exported from Swansea during the year just ended. During the past year the extensive docks at Briton Ferry have been opened, which has given a great impetus to the shipment of coal and iron at that port, more especially in the coasting and European trades. The official returns have not yet been prepared, and the same remarks apply to Neath and Llanelly, but we are in a position to be able to state that they will each show a considerable increase of trade as compared with the previous year.

NORTHERN COUNTIES.

In the Newcastle district all attention is absorbed in the terrible accident at Hartley New Pit. The scene of the catastrophe, and an outline of the history of the colliery, is thus given by the *Newcastle Daily Chronicle*:—

"'Hartley' is the name by which the 'steam coals' of the Great Northern Coal Field are generally known, in the same way as 'Wallsend' is the name by which our northern 'household coals' are popularly described. The name given respectively to these two classes of coals simply arises from the special kinds of coals being found, one at and near Hartley, and one at and near Wallsend. When coal owners or factors talk of 'Hartley

coals,' they are understood to mean coals well adapted for raising steam in marine and other boilers; and when they talk of 'Wallsend coals,' they mean coals well adapted for house purposes. The collieries in this district from which steam coal is got are situated along the Northumberland seaboard, extending from about Killingworth to near Warkworth. Hartley, Barradon, Seghill, and Cowpen, are four of the chief steam collieries in Northumberland. Seghill is the oldest of the lot. It was sunk about forty years ago, about the same time as the neighbouring colliery of Cramlington. It was fully expected, when these mines were put down, that coal of the quality and value of the main coal seam at Wallsend and Gosforth would be obtained. The owners were, however, disappointed in their expectations in this respect, and for some time it was feared that the undertakings would be entire failures. The value of steam coals was not then known, and it was not for some years after that their real worth was discovered. When that became known, the value of Seghill and all the surrounding collieries rose very rapidly. Now, and for a number of years past, it is well known that the collieries in that part of Northumberland have been the most valuable in the north of England. Messrs. John Carr and Co. were the lessees of all the above four collieries up to 1858. But in that year, owing to the disastrous effects the commercial panic of 1857 had upon their property, the Messrs. Carr were compelled to relinquish possession of them. The four collieries were sold by public auction in Newcastle, on July 20th, 1858. Seghill, which is situated about six miles north of the Tyne, was bought by Mr. Joseph Laycock. The colliery stock and plant alone was valued at £22,392. 4*s*. 11*d*. The whole concern, including the land attached—about 800 acres—farm stock and lease, &c., brought £93,000. Cowpen Colliery is situated near Blyth, and about eleven miles north from the Tyne. This colliery, having 304 workmen's cottages, and the lease of a farm containing 107 acres attached, was purchased by Messrs. Jos. Straker and partners for about £120,000. Burradon Colliery lies to the west of Seghill, but is about the same distance from the Tyne. It was sold to Mr. Joshua Bower, of Leeds, for £50,000, including workmen's cottages and other erections. Hartley Colliery is in the parish of Earsdon, and is nearer the coast than either Seghill or Barradon, but not more than six or seven miles direct north from the Tyne. It is an old-established concern, and was worked by Messrs. John Jobling and partners before it came into the possession of the Messrs. Carr. There are three seams in the mine. The High Main, at a depth of 38 fathoms, is four feet six inches thick. This seam is all but worked out. The Yard Coal is at a depth of 65 fathoms, and, as its name indicates, is a yard thick. The Low Main Seam, which is the present working one, is about 95 fathoms deep. It was sunk in 1830, a previous shaft, 80 fathoms deep, having been abandoned. The coals are chiefly shipped at the artificial harbour of Seaton Sluice, by a private railway of about two miles long. The colliery is held under an agreement for lease from Lord Hastings for twenty-five years, from May 1st, 1844, and comprises about 3,000 acres of coal. The certain rent is £1,200 per annum for the first three years of the term, and £2,000 per annum for the residue of the term. The lessees may surrender at the end of any year, with power to make up 'shorts,' of which £13,000 were estimated as due in 1858. At the public auction of the other three collieries, in 1858, Hartley was withdrawn, arrangements having been made with Lord Hastings for the Messrs. Carr to continue working the concern. The vend is estimated at from 90,000 to 100,000 tons. When the above collieries were disposed of, all of them except Burradon were sold subject to an agreement with the Tyne Improvement Commissioners that all the coals shipped by them in the River Tyne should be shipped in the Northumberland Dock during the existing lease or any renewed leases not exceeding fifty years from March 28th, 1852. In 1858, when the three collieries—Seghill, Burradon, and

Cowpen — were sold, their aggregate vend of large coal was not less than 410,000 tons. Since the commercial panic in 1857, the Messrs. Carr have been most unfortunate. At that time they ranked amongst the foremost men in the northern coal trade. Since then misfortune after misfortune has followed them. Not two years ago the calamitous explosion at Burradon took place, when the colliery was under the charge of Mr. Charles Carr, and now this said accident at Hartley has befallen them. Very general sympathy is felt for them in the district, although, at the same time, the system of working so large a colliery with only one shaft, is very widely condemned, and government interference with the plan, which is not uncommon, is talked about in various, though not influential quarters. In the present instance, blame is attributed to the managers, for not continuing the 'staffle,' with its ladder, to the high main seam, in which case it is believed that the unfortunate men could have been rescued in a few hours. With respect to the future of the colliery, it is thought that no attempt will be made to work it again, at all events not in the present condition of trade. It has never been a very profitable concern, and this accident will involve an outlay which it may not be thought worth while to invest. The particulars of the accident are too well known to require any description here. With regard to the shaft itself it was of very capacious dimensions, divided at the centre by a wooden brattice through its entire length, thus dispensing with a second pit. Adjoining the pit on the east side is the engine-house. Ever since its formation Hartley New Pit has been subject to floods, and it is only very recently that by means of most ponderous machinery the miner has been enabled to continue his labours. Some six or seven years ago, the colliery was completely inundated in consequence of the machinery being too light for the feeder, and was obliged to be laid in. About four years ago the present pumping engine, the largest of its kind we believe in the north of England, was erected. The beam weighs no less than forty tons. Still, notwithstanding the matchless machinery, the water continued to inundate the workings, For a time it was thought that the sea must have been struck, and the abandonment of the colliery was all but decided upon. It was only since they holed into the old workings of the 'Mill Pit' that the owners have had the satisfaction of seeing their expensive undertaking free of water, and of receiving some remuneration for their capital. The accident occurred about ten o'clock on Thursday morning, January 16th. Had it taken place a little later on in the day, its effects would have been comparatively trifling, for the night shift being in process of coming to bank, the pit in a short time would have been deserted. Out of the 200, however, whose hours of labour had expired, only sixteen had left the shaft, and eight more were at the moment being drawn to the bank in the cage by means of the winding machine. When about half way up, the ponderous beam of the engine snapped at the axle, and the outer half—a mass of iron upwards of twenty tons in weight—fell sheer down the shaft. The falling mass appears to have first struck the brattice, which it smashed and scattered like chaff in its downward career. The iron cage, in which the men were riding to the top, was shattered, and its unfortunate inmates overwhelmed by an avalanche of *debris*. Two of the unfortunate men were instantly killed and precipitated to the bottom, while three others lingered only a very short time after being struck. The remaining two were also injured, but not seriously, and after the expiration of twelve weary hours, during which every exertion was made to save them, they were ultimately rescued and brought to the bank. One lad, named William Sharp, managed to climb half way up the pumps, and there held on until relieved.

It was soon found that the portion of the shaft above the yard-seam had been completely blocked up with the *debris* broken by the fall of the beam, and that upwards of 200 men and boys had been buried alive.

The noble efforts made to save these, and the unhappy failure of all these endeavours, are matters of history, which will live longer in the minds of English people then the records of many battles and sieges. All the bodies of the men in the Yard seam were recovered by Sunday, the 26th. A good deal of discussion has already taken place in the newspapers on this lamentable affair; but we prefer reserving any observations on it until after the official inquiry which will take place. It must be remembered that the accident is one almost without precedent.

THE IRON TRADE OF NORTHUMBERLAND, DURHAM, AND NORTH YORKSHIRE. —From the circular of Mr. Hoyle, of Newcastle, we make the following extract respecting the increasingly important trade of Northumberland, Durham and Cleveland:—Referring to that now great rival district on the north-eastern coast of England, and in the proceedings of which much interest is now felt by the trade, what are the results which may be reported from the operations of last year? The number of furnaces that have been in work, for longer or shorter periods throughout the year, is 66. The aggregate produce of pig-iron from these furnaces may be estimated at 607,000 tons. The present number in operation is 60, and there are now 40 furnaces out of blast. The disposal of the pig-iron made may be stated as follows:—

		Tons.
Total stock, January 1st, 1861		62,000
Make during the year		607,000
		669,000
Shipped for exportation abroad	103,000	
Used in the rolling mills and foundries in district, shipped for delivery coastwise, and sent away by rail	506,000	
		609,000
Total stock in the hands of makers and in store, January 1st, 1862		60,000

These statistics, compared with those of the previous year, show the following results:—That 66 furnaces in all have been employed in place of 68, and that the make has been curtailed by about 26,0 0 tons. That 60 furnaces are now in blast, instead of 65 at the close of 1860. The foreign exports show an increase of 38,300 tons compared with the foreign shipments of 1860, and the home consumption a diminution of something like 74,300 tons. The stocks are two thousand tons less than they were twelve months ago, and from their insignificance, contrast strikingly with the enormous stocks on hand in Scotland. It may be asked, Why this amazing discrepancy? The answer is simply this, that in the north of England there exists no class of buyers, as is the case in Scotland, intermediate between the producer and consumer: the consequence is, that beyond the ability or inclination of the maker to hold, the manufactured article passes directly from the furnaces into consumption. In the absence of the artificial element that prevails in Scotland, the make of pig-iron is regulated by the demand for consumption, and thus the large stocks that press so heavily on the Scotch market are avoided. Here, as in Scotland, the large number of furnaces ready to light on the revival of trade must for some time keep in check any tendency to an advance in price; whilst, on the other hand, it may be stated that in the Cleveland locality large rolling mills in connection with some of the furnaces have been built, and others are in course of erection, the effect of which will be to take out of the market a large portion of the pig-iron made in the district. Throughout the year, the quotations issued from an official source have ranged from 50*s.* to 47*s*. 6*d*. for No. 1, and from 45*s*. to 44*s*. for No. 3, shipped free on board. The present quotations are 50*s*. No. 1, and 44*s*. No. 3.

Mining, Quarrying, and Smelting Accounts and Meetings.

CORNWALL AND DEVON.

At the Clifford Amalgamated Mines (Dec. 18th), the accounts showed—Mine cost, Sept., £2,413. 3*s.* 11*d.*; Oct., £2,722. 13*s.* 5*d.*; tributers' balances, £307. 11*s.* 7*d.*; merchants' bills, £2,870. 11*s.* 7*d.*; coals, on account, £1,390; Redruth and Chasewater Railway bill, £258. 15*s.*; Clifford adventurers' materials, £236. 13*s.* 8*d.*; United Mines ditto, £107. 12*s.* 4*d.*; Trefullack ditto, £19. 3*s.* 9*d.*; ticketing expenses, £11. 14s. 11*d.*=£10,338. 0*s.* 2*d.*—Ore sold and sundries £9,202, 7*s.*; leaving debit balance, being loss, £1,135. 13*s.* 2*d.* Captain John Richards reported that Wheal Clifford district was looking very well. In United Mines, though very poor at present, there were several points to explore which held out encouragement for future success. The accounts, as was expected, show a loss of rather more than £1,100; to account for this, there is but one month's ore credited against two months' cost; and the bills have been very heavy, so as to get the machinery above and below ground in a proper state of working. At the next account they will pay off this debt on the book, and leave from £2,000 to £2,500 profit.

At Rosewall Hill and Ransom United Mines (Dec. 23), the accounts for the three months ending Oct. shewed—Balance last audit, £357. 9*s.*; tin sold, £1,753. 5*s.* 10*d.*=£2,110. 14*s.* 10*d.*—Mine cost, merchants' bills, and sundries, £1,546. 6*s.* 4*d.*; leaving credit balance, £564. 8*s.* 6*d.* The profit on the three months' working was £206. 19*s.* 6*d.* Capts. Treweeke and Thomas reported favourably upon the position and prospects of the mine.

At East Devon Great Consols Mine (Dec. 30th), the accounts showed—Balance last audit, £32. 16*s.* 10*d.*; mine cost, four months ending November, £662. 8*s.*; sundries, £5=£709. 4*s.* 10*d.*—By calls, £373; leaving to debit, £327. 4*s.* 10*d.* A call of 3s. per share was made. Capts. T. Neill and T. Richards, in reporting on the mine, say—"The 40 fm. level cross-cut south has been extended altogether about 30 fms., and two lodes found therein, which are composed of beautiful spar, mundic, and copper ore. We are extending on the last lode met with; its appearances are very favourable, in good ground for mineral, and its direction being very fast south of east. In about 20 fms. more driving it will form a junction with the south copper lode, which in the Devon Consols, within the last few months, has been found and still continues very productive for copper ore. This must be considered as a highly favourable feature for East Devon, and we do not see (to ensure the same results) any better course to adopt for the future than to continue on the present operations; and seeing such a change for the better has taken place in the character of the lode at the 52, we are sanguine that an extension westward at this level, driving the 40 to intersect the south copper lode, and cutting the lode at the 64, will open up a valuable and productive mine. The operations progress favourably, and the engine and pit-work are in good order and working well.

At Budnick Consols (December 30—Rev. E. J. Treffry in the chair), the accounts for the four months ending September showed—Balance last audit, £,2544; mine cost, merchants' bills and sundries, £3,073. 12*s.* 9*d*, =£5,617. 12*s.* 9*d.*—Calls received, £1,697. 9*s.* 7*d*; tin sold, £1,307. 5*s.* 4*d.*: leaving debit balance, £2,612. 17*s.* 10*d.* A call of 10*s.* per share was made. The committee reported that since the last meeting capitalists of high standing have purchased shares to the extent of one-fifth of the whole mine. The Duchy of Cornwall have liberally consented to reduce the rate of dues since September, 1860, from 1-18th to 1-60th dish, and the committee think that the other lords of the soil would benefit themselves as well as the adventurers by consenting to similar reductions. Captains Puckey and E. Dunstan have inspected the mine, and have reported favourably upon it; and Captains Evans and Mitchell, the agents of the mine, state that the stopes are yielding moderate stamping work; the tribute pitches on the whole are improved since last account, and returns will probably be increased when the 40 and 50 fathom levels are drained.

At the Pendeen Mine (December 31—Mr. Bawden in the chair), the accounts for the two months ending December showed a loss of £374; and a general statement of assets and liabilities showed a balance in favour of the mine of £1,104.

At Ashburton United Mines (December 31—Mr. John Arnold in the chair), the accounts for the three months ending November showed—Balance last audit, £1,250. 0*s.* 1*d.*; mine cost, merchants' bills and sundries, £2,386. 9*s.* 4*d.* = £3,636. 9*s.* 5*d.*—Tin sold, £1,288. 2*s.* 7*d.*; calls received and sundries, £1,837. 1*s.* 7*d.*: leaving debit balance, £511. 5*s.* 3*d.* Capt. Wm. Edwards reported that the number of hands employed was 150. The 24-inch cylinder engine and boiler are complete, is all on the mine, and the rest of the machinery and surface operations are working satisfactorily.

At New Wheal Seton (December 31), the accounts for four months ending October showed a debit balance of £218. 13*s.* 11*d.*, and a call of 30*s.* per share was made. The shaft is down 7½ fathoms under the 42, where they have a promising lode; the other levels are looking very encouraging. Surrounded by good mines, there is little room to doubt of this becoming equally productive when fully developed.

At East Gunnislake and South Bedford Mines (December 31—Mr. W. A. Thomas in the chair), the accounts for the three months ending October showed—Balance last audit, £374. 11*s.* 11*d.*; ore sold and carriage, £369. 0*s.* 11*d.*; calls received, £641. 7*s.*=£1,384. 19*s.* 10*d.* Mine cost, merchants' bills and sundries, £1,261. 14*s.* 1*d.*; leaving credit balance, £123. 5*s.* 9*d.* Messrs. W. G. Gard and J. Phillips reported that they had the same elements of success in view as made Gunnislake, Luscombe, and Wheal Crebor so profitable.

At the Wheal Basset and Grylls (Dec. 30), for the three months ending October, the accounts showed—Ore sold, Oct., £643. 11*s.* 8*d.*; Nov., £951. 4*s.*; Dec., £2,306. 19*s.* 3*d.*; extra price for tin sold Sept. 30th, £18. 14*s.* 6*d.*= £3,920. 9*s.* 5*d.*—Balance last audit, £282. 12*s*; mine cost. Aug., £848. 13*s.* 4*d.*; Sept., £830. 10*s.* 5*d.*; Oct., £816. 16*s.* 3*d.*; merchants' bills, £865. 1*s.* 1*d.*; dues, £172. 10*s.* 2*d.*; surgeon's pence, £17. 9*s.* 6*d.*: leaving credit balance, £86. 16*s.* 8*d.* The profit on the quarter's working was £369. 8*s.* 8*d.* Captain Wilkin's salary was fixed at 12 guineas per month. It was resolved that the arrangement made by the deputation (appointed at the meeting of adventurers) with the several lords for the reservation of 1-20th dues in the several setts—1-24th to be received during pleasure—be approved and confirmed; and that the grantees be authorised and requested to execute the several counterparts of the setts. The report of the agents (Capts. J. B. Wilkin, W. Harris, and S. Tredinnick) stated that the total number of hands employed was 318, out of which there were 75 men on tutwwork, and 50 tributers. Upon the whole the mine was in a fair way of developing itself, and they hoped when the eastern part of the mine became productive to return profits.

At South Wheal Frances (Jan. 6), the accounts for October and November showed a credit balance of £2,423. 11*s.* 7*d.* The profit on the two months was £499. 18*s.* 1*d.* A dividend of £496 (£1 per share) was declared, and £1,927. 11*s.* 7*d.* carried to credit of next account.

At Grambler and St. Aubyn Mines (Jan. 7), the accounts for Oct. and Nov. showed—Balance last audit, £179. 10*d.*; mine cost, merchants' bills and sundries, £643. 4*s.*=£822, 4*s.* 10*d.*—Calls received, £486; copper ore sold (deducting £12. 10*s.* 3*d.* dues, at 1-18th), £212. 14*s.*: leaving debit balance, £123. 10*s.* The loss on the two months' working was £430. 9*s.* 2*d.* A call of £1 per share was made. Application will be made to the lords for the remission of their dues. Capts. J. Davey and J. Mitchell reported that they had not cut the lode in the 25 cross-cut, south of engine-shaft, but hope to do so shortly.

At North Treskerby Mine (Jan. 7), the accounts for the three months ending November showed—Balance last audit, £1,218. 1*s.* 4*d.*; copper ore and tin-stuff sold, £2,197. 1*s.* 9*d.*=£3,415. 3*s.* 1*d.*—Mine cost, merchants' bills, and sundries, £2,639. 11*s.* 9*d.*: leaving credit balance, £775. 11*s.* 4*d.* The apparent loss of £442. 10*s.* arises from three months' cost being charged against two months' ore money.

At the Cook's Kitchen Mine (January 7), the accounts showed a credit balance of £941. 17*s.* 4*d.*, and a dividend of 7*s.* per share was declared.

At the Marke Valley Mine (January 8th), the accounts for the three months ending November showed—Balance last audit, £3,780. 1*s.* 4*d.*; ore sold £5,892= £7,672. 1*s.* 4*d.*—Mine cost, £2,882. 17*s.* 2*d.*; lords' dues and sundries, £560. 5*s.* 7*d.*; dividends paid, £2,221. 5*s.*: leaving credit balance, £4,007. 13*s.* 7*d.* A dividend of £2,000 (6*s.* per share) was declared. As the November ores realised £1,694. 8*s.* 2*d.* there remains, after payment of this dividend, £2,890. 15*s.* 9*d.* to credit of the next account.

At EAST CARADON MINE (January 8th), the accounts for the three months ending December showed—Balance last audit, £1,870. 1*s.* 4*d.*; ore sold, £6,557. 10*s.* 7*d.* =£8,427. 11*s.* 11*d.*— Mine cost, merchants' bills, sundries, £2,302. 17*s.* 4*d.*; leaving credit balance, £6,124. 14*s.* 7*d.* A dividend of £4,608 (15*s.* per share) was declared, and £1,516. 14*s.* 7*d.* carried to credit of next account.

At the WHEAL JANE (KEA) (January 10), the accounts for September and October showed—Balance last audit, £811. 6*s.* 1*d.*; ores sold, £2,316. 12*s.* 2*d.*; due on mundic overcharged end of June, £1. 4*s.*; debts, &c., from tributers, £2. 11*s.* 11*d.*; errors in Messrs. Vivians and Treglown's bills, £7. 7*s.* 7*d.*=£2,636. 17*s.* 1*d.*—Mine cost, merchants' bills, &c., September, £575. 0*s.* 2*d.*; October, £774. 15*s.* 9*d.*; dues and returning charges on tin ores, £145. 3*s.* 1*d.*; overcharged on mundic, £18. 6*s.* 2*d.*; discount on ore bill, £3. 4*s.* 5*d.*: leaving credit balance, £1,120. 7*s.* 6*d.* Upon the two months' working there was a profit of £811. 6*s.* 1*d.* A dividend of £512 (£1 per share) was declared, and a balance of £608. 7*s.* 6*d.* carried to the credit of the next account. The report of the agents (Capts. T. Bray and W. Giles) recommended that a perpendicular shaft should be forthwith sunk to the north of Gilbert's shaft. The tribute department was looking fair, and they had 18 pitches working, at from 3*s.* 3*d.* to 13*s.* in £1; employing 54 men and two boys; 12 tutwork bargains employing 39 men and 35 boys. From the prospects of the mine, and the sacrifice made by selling their tin-stuff, they believed they were justified in recommending the purchase of a steam-stamps, whenever an opportunity presented itself, having already made the necessary preparations at the steam-whim for the connection of the same. Agreeably with the recommendation contained in the report, it was agreed, upon the proposition of Mr. Treseder, seconded by Mr. J. Tonkin, that a perpendicular shaft should be forthwith sunk to the north of Gilbert's shaft.

At ROSEWARNE UNITED MINES (January 13), the accounts showed—Mine cost, merchants' bills, and sundries, £1,616. 0*s.* 10*d*; balance from last audit, £13. 5*s.* 5*d.*; copper ore and tin-stuff sold, £1,569. 4*s.* 5*d.*: leaving debit balance £33. 11*s.* Capts. T. Richards, Woolcock, and Carthew, reported that there were employed underground 52 men on tutwork and 60 on tribute.

At NORTH ROSKEAR MINE (January 14), the accounts showed—Ore sold, £3,092. 6*s.* 6*d.*—Balance last audit, £21. 6*s.* 8*d.*; mine cost, merchants' bills, and sundries, £2,975. 11*s.* 7*d.*; leaving credit balance, £95. 8*s.* 3*d.* Capts. Vivian, Dunkin, and Angove, reported upon the various points of operation; they calculate a small profit at their next two-monthly account.

At the TRYPHENA PENDARVES MINE (January 14), the accounts for four months ending November showed a debit balance of £1,559. 1*s.* 3*d.* and a call of 30*s.* per share was made. Capts. R. Pryor and J. Rule reported:—"Twelve heads of stamps are in course of erection, to be attached to the water-wheel, which we hope will be working within three weeks. The engine continues to work well, and keeps the water with about four strokes a minute."

At the NEW GODOLPHIN MINE (January 15.—Mr. Frederick Hill in the chair), the accounts showed—Tin sold, Oct., Nov., and Jan. (per contract), less dues, £48. 7*s.*—Mine cost, Oct., Nov., and Dec., £39. 15*s.* 11*d.*: leaving profit upon the three months of £8. 11*s.* 1*d.* The report of Capt. James Pope stated that, looking at the sett generally, together with the appearance of the strata, cross-courses, and elvans, and the junction of granite and killas, he did not hesitate to say it was one of the best pieces of mining ground now idle in Cornwall, and could recommend it as such to any company of gentlemen inclined to speculate in mining. The report of Capt. Nicholas Tredinick was to the effect that the sett was worthy a fair trial.

At WHEAL BULLER (January 21), the accounts showed—Balance last audit, £648. 5*s.* 4*d.*; copper ore sold, £1,317. 0*s.* 11*d.*; tin, £1,449. 10*s.* 11*d.*; sundries, £72. 2*s.* 10*d.*=£3,487.—Mine cost, November and December, £1,856. 16*s.* 6*d.*; merchants' bills, £759. 2*s.* 3*d.*; dues, £172. 18*s.* 2*d.*: leaving credit balance, £698. 3*s.* 1*d.* Upon the two months' working there was a profit of £49. 17*s.* 9*d.* The report of the agents (Captains J. Davey, J. Johns, and J. Uren) stated that, from the appearance of the mine at the last account, they thought they might have been able to make a small dividend upon the present occasion, but the tin-stuff had not proved so good as they then anticipated, and the fall in the price of tin had prevented it. The costs for the future would rather exceed that of the present two months. More men would be required to develop the north lode at Stevens's.

At WEST BASSET MINE (January 22), the accounts for October and November

showed—Labour cost, £2,050. 8*s*. 1*d*.; merchants' bills, £1,342. 2*s*. 10*d*.; tribute, £1,329. 12*s*. 8*d*.; royalty, £323, 18*s*. 7*d*.; advance on tribute, £400; new engine, £1,400; sundries, £30. 8*s*. 7*d*.=£7,678. 10*s*.—Balance last audit, £2,142. 4*s*. 3*d*.; received advance on tribute, £300; materials sold, £186. 14*s*. 5*d*.; fines, £1. 5*s*.; copper ores sold, £5,048. 6*s*. 4*d*.: leaving credit balance, £801. 19*s*. 3*d*., which, together with ore bills not yet at maturity, amounts to £7,139. 12*s*. 6*d*., applicable to the general purposes of the mine. Capt. Roberts reported favourably upon the prospects in sinking Grenville's shaft, and estimated the next sampling to be about 480 tons.

At the Wheal Kitty, St. Agnes (January 23), the accounts showed a loss upon the three months' working of £92. 15*s*. 10*d*. The report from Capt. R. Pryor was considered of the most satisfactory character. It stated that the new lode cut in the 54 cross-cut south was worth £15 to £20 per fathom, and that it might be intersected from every level, above and below. As the 54 was the most western end in the mine, he considered the cutting of this lode would have a most important effect upon the welfare of the mine.

The directors of the Devonshire Great Consolidated Copper Mining Company, at their board meeting (January 24), declared a dividend of £8,192, being £8 per share, arising from profits on sales of copper ores sampled in the months of September and October, last. After payment of the same there remains in hand a balance of £24,244 19*s*. 6*d*. in cash, ore bills not at maturity, and reserved fund, applicable to the general purposes of the company.

WALES.

At Bryn Gwiog Mine (January 22), the statement of accounts showed—Call received, £500; Ore sold, £1,344; sale of old materials, £19. 3*s*. 5*d*.=£1,863. 3*s*. 5*d*.; balance last audit, £214. 0*s*. 5*d*.; mine cost, October, November and December, £1,052. 19*s*. 9*d*.; merchants' bills, £219. 8*s*. 3*d*.; doctor's pence, &c. £3. 1*s*. 4*d*.; dues, £80. 17*s*.; interest and discount, £22. 19*s*. 10*d*.; incidental expenses, 18*s*. 8*d*.=£1,594. 5*s*. 3*d*.; leaving credit balance, £268. 18*s*. 2*d*.

At the Vigra and Clogau Mine meeting (January 24,—Mr. Martin in the chair) the accounts from the commencement of the workings to December 31, showed—Capital subscribed, £11,550.; gold sold (2,886 ozs. 3 dwts., yielding 2,784 standard ounces), £10,816. 17*s*. 2*d*.; balance of interest, £1. 12*s*. 3*d*.; debts and liabilities, £796. 8*s*.=£23,164. 17*s*. 5*d*.—Plant and machinery, £11,554. 14*s*. 11*d*.; May, July, and October dividends paid, £3,675.; royalties, rent, and fees, £1,091. 3*s*. 1*d*.; working expenses, 12 months to January 1 last, £1,931. 0*s*. 10*d*.; leaving credit balance (including gold on hand, £4,796. 12*s*. 2*d*.), £4,912. 18*s*. 7*d*.. A dividend of £3,150 (15*s*. per share), free of income tax, was declared. Mr. W. H. Ashurst was elected a director. The yield for the last fortnight has been 193½ ozs., being an excess of about 13 ozs. on the previous return.

COLONIAL AND FOREIGN.

At the Port Philip and Colonial Gold Mining Company meeting, on Wednesday (January 8th,—Mr. J. D. Powles in the chair), the accounts showed a balance standing to the credit of profit and loss of £24,780, out of which a dividend of 1*s*. 6*d*. per share was made (forming with the distribution of 1*s*. per share declared in July last, the fourth dividend), and being at the rate of 12½ per cent. per annum. A vote of £500 was passed to the three original directors—Messrs. J. D. Powles, Sir C. H. J. Rich, and Captain J. Vetch, R.E.,—in consideration of their gratuitous services from 1852 to 1858. The retiring directors and auditors were re-elected. The company's proceedings have gone on at Clunes without interruption. The quantity of quartz crushed between October 1, 1860, and September 30, 1861, has been 32,258 tons, from which the produce has been 24,336 ozs. 6 dwts., being an average of 15.2 dwts. per ton. The quantity crushed during the preceding year was 21,694 tons, and the produce 17,466 ozs., being an average of 16 dwts. per ton; showing an increase in crushing of 10,564 tons, and an yield of gold of 6,870 ozs. over the same period of the previous year. It will be perceived that the yield of gold per ton has experienced a variation of 22 grs., equal to 5¾ per cent. The total expenditure per ton has been 12*s*.; in the preceding year it was 16*s*. The expenditure this year includes a considerable sum incurred in

additions and permanent improvements, such as the melting-house and materials, large lathe and additions to the fitting shops, a small engine, and fitting up the Chilian mill. The profit on the quartz crushing for the year ending September 30 has been £22,958. 16*s*. 5*d*. The quantity of quartz stamped since the commencement of operations at Clunes has been 86,961 tons. In 1857 (six months), 4,146 to s; 1858 (twelve months), 13,321 tons; 1859, 17,542 tons; 1860, 21,694 tons; and in 1861, 32,258 tons. The machinery during the year has worked very satisfactorily. The Clunes Mine has during the year been worked energetically; the north shaft is about being sunk deeper, and the mine more extensively opened out. In consequence of its having been stated that an improved process for the treatment of auriferous ores had been devised at Freyberg, in Saxony, and was in operation at a mine in the extreme south of the Prussian territory, two of the members of the board, Mr. Macdonnell and Captain Vetch, accompanied by a gentleman conversant with the German language, proceeded there in August last. Their journey occupied upwards of six weeks; they obtained all the information in their power on the subject, both at Freyberg and at the mine in question. They afterwards proceeded to Vienna, where they obtained from the able and experienced secretary of the Aulic Council of Mines, Mr. Hocheder, information as to the treatment of the like mineral in the mines belonging to the Austrian dominions. The whole of the information so obtained, together with accounts of the treatment pursued at the company's establishment at Clunes, have been placed in the hands of Dr. Percy, Professor of Metallurgy in the Government School of Mines in Jermyn-street, by whom the question is undergoing an elaborate investigation. Dr. Percy has required, in addition to the information in his hands, that a portion of the "tailings," or "refuse," remaining after the extraction of the gold, shall be brought from Clunes, which has been ordered to be done. In the meanwhile, there is ground for hoping that means will be found by this investigation for diminishing the loss now sustained in the extraction of gold.

The financial statements show that the company have an available balance of assets over liabilities in England, £11,993. 12*s*. 10*d*.; and at Melbourne, £1,314. 8*s*. 7*d*. The reserve fund amounts to £2,160. 7*s*. 11*d*. New Three per Cents. The balance standing at the credit of profit and loss is £24,780. 1*s* 9*d*., out of which the directors recommend the payment of a dividend of 1*s*. 6*d*. per share, payable on January 15th, 1862, forming, with the distribution of 1*s*. per share declared in July last, the fourth dividend, and being at the rate of 12½ per cent. per annum. The subjoined statement shows the position of the company :—

Balance standing at the credit of the capital account, being the amount of capital remaining after charging to the debit of the account the losses sustained in the first years of the company's existence, £30,777. 13*s*. 2*d*.; balance at credit of profit and loss, being the amount of undivided profit £24,780. 1*s*. 9*d*.; reserve fund £2,033. 1*s*.; total, £57,590. 15*s*. 11*d*. Clunes Mining Establishment, £35,000; materials shipped to Melbourne, not arrived at Clunes, £1,606. 1*s*. 11*d*.; land and buildings at Melbourne, £5,000; office furniture, £181. 4*s*. 9*d*.; cash at Melbourne, £1,314. 8*s*. 7*d*.; cash and bills in London, £12,830. 19*s*. 8*d*.; less to pay on account of fourth dividend, £375=£12,455. 19*s*. 8*d*.; new Three per Cent. Consols (£2,160. 7*s*. 11*d*.) £2,033. 1*s*.; total, £57,590. 15*s*. 11*d*.

At the second ordinary general meeting of the proprietors of the GREAT NORTHERN COPPER MINING COMPANY OF SOUTH AUSTRALIA, held at the London Tavern, Bishopsgate, January 20th,—Mr. G. H. Donaldson in the chair, the following report was read :—The directors have much pleasure in submitting to the shareholders at this the second annual general meeting a statement of accounts from Nov. 3, 1860, to Nov. 3, 1861. It will be seen that the total expenditure for the year amounted to £17,727.4*s*.; and that the ore sold during that period (amounting to 205 tons) realised £4,801. 10*s*. In addition to the ore actually sold, the company have about 375 tons of ore shipped, which, at the average price of the sales already effected, may be expected to produce £8,700. A further quantity of 445 tons is now in course of transit from the mines to Port Augusta. Nearly the whole of this ore has been raised from one mine, while the expenditure has been incurred in opening up five or six mines, at considerable distances from each other. Several of these mines are now yielding rich ore, and we may confidently expect largely increased returns from them in the ensuing year. The directors are happy to say, that the claim set up for an interest in the Nuccaleena Mine has been withdrawn, and the lease duly vested in the company, so that all risk of litigation on the subject

is at an end. The monthly reports of Capt. J. B. Pascoe continue to testify in the strongest manner that the mineral properties acquired by this company are likely to become largely remunerative. From these reports it will have been observed that the various mines are being opened with energy. A steam-engine, with requisite machinery, has been purchased in the colony on reasonable terms, and is now in course of erection at the Nuccaleena Mine, for the purpose of raising and crushing the ore in increased quantities; and orders have been lately given for a portable steam-engine, which will be forwarded to the colony as soon as it is ready, in order to meet the probable requirements at one or other of the mines. Mining labour continues to be obtainable at reasonable rates, but your directors intend again to urge on the colonial government the propriety of sending additional miners to the colony, in order that the supply may be adequate to the increasing demand. Cartage continues ample, and our local committee have advised a considerable reduction in the rate hitherto paid. The surveyor-general of the colony has assured the local committee that a township shall be immediately established in the neighbourhood of the Nuccaleena Mine. This will tend greatly to reduce the cost of operations at the company's mines, while at the same time it adds to the comforts of the men employed.

The Chairman, in moving the adoption of the report and accounts, was happy he could congratulate the proprietors upon the position and prospects of the undertaking. He believed he was justified in saying that few undertakings could, after a period of about fifteen months, show such results achieved. Notwithstanding the causes which had militated against their progress, in that short interval there had been actually sold nearly £5,000 worth of ore and about £9,000 worth shipped. In addition to that there were about 445 tons in course of transit from the mine to the port of shipment, and according to the estimate by Capt. Pascoe, in his September report, the quantity of ore in sight at the Nuccaleena Mine was 1,500 tons, which he valued at £30,000. After deducting the amounts paid to Mr. Bonny, and between £5,000 and £6,000 incurred in providing plant and machinery, the total working expenses, both at home and in the colony, did not exceed £12,000. As to their future prospects, he could only say it was his opinion, and that of his colleagues, that the Great Northern Copper Mining Company would prove a valuable and an important undertaking. In reply to enquiries, the Chairman stated that there had been 205 tons sold, which realised £4,800; 375 tons had been shipped, the value of which was estimated at £8,700; and there were 445 tons in course of transit from the mines to the port of shipment. In addition to which there were 1,500 tons of ore in sight. He also states that at present the cost of cartage from the mines to the port of shipment was £5 per ton, but the local committee led them to believe there would be a considerable reduction in that respect. As to the freight, it cost about 7*s*. 6*d*. per ton of ore from the port of shipment to England.

It was then unanimously resolved that the report of the directors and the statement of accounts be received and adopted, the directors consenting to receive £550 per annum for their services.

Metal Markets.

The following weekly reports from Messrs. Dadelszen and North, metal brokers, Leadenhall Street, show the position of the market during the month. *January 8th*.—There is scarcely any business doing in metals; buyers are evidently waiting for definite advices from America, and sellers are encouraged in their demand for higher prices by the peaceable complexion of the news already received.

Iron.—Welsh bars in moderate demand at £5. 2*s*. 6*d*. f.o.b. Wales, and £6 per ton here. Staffordshire iron without change. Scotch pig iron has fluctuated from time to time, closing buyers at 48*s*. 9*d*.; cash m. n. warrants.

Copper is dull. English raw is obtainable £5 per ton under official prices, and manufactured at ½*d*. per lb. Foreign neglected. Burra and Kapunda £102 to £103, nominally.

TIN quiet, but steady; small parcels of banca have changed hands at from £121 to £122. We quote straits £117. The Dutch market has further improved to 73½f.

TIN PLATES are in better demand since the prospect of a rupture between America and ourselves seems likely for the present at least to be averted.

LEAD.—There is but little doing, without any alteration in price.

SPELTER.—This article has partially recovered after its heavy decline; holders of cash parcels here asking £18. 5s. Hull parcels, £18. 2s. 6d., W. H. £18. 15s.

January 15*th*.—There has not been that amount of business in the metal trade this week which we had every reason to expect. Holders adhere firmly to previous quotations, but operators use the greatest caution, and consumers only buy for their immediate wants.

IRON.—No change has taken place in the position of either Welsh Bars or Staffordshire Iron. The demand is languid. Scotch Pig iron has been in buyer's favour, closing at 48s. 4½*d*. cash.

COPPER continues extremely dull. English manufactured and raw are to be had below official quotations. But few transactions have been reported in Foreign. We have sellers of Burra and Kapunda at £103; buyers to a limited extent at £102; Chili Slabs, £91 to £92.

TIN continues steady, but there is not much business doing. We quote Banca from £123 to £124, and Straits £120 to £121, according to time of payment. There is good demand for English at fixed prices; this is now relatively considerably under foreign.

TIN PLATES.—There is more enquiry and prices stiffening.

LEAD remains unaltered in value. English pig £20. 5s.

SPELTER.—Some little business has been done at £18. 5s. to £18. 10s. spot, and with a month's prompt, holders generally ask £18. 10s. Hull parcels from 2s. 6d. to 5s. under our quotations here.

January 22*nd*.—The general aspect of the metal market has not changed since our last report; dulness is the prevailing feature, and one can only hope that a gradual but steady improvement will take place before long.

COPPER.—Although English copper is still obtainable under official quotation and in slack demand, holders of foreign evince more firmness. Burra and Kapunda £103 to £104. Chili slab has been sold to some extent in Liverpool, at £91 to £91. 10s. for export. Nearly the whole stock of Baltimore and Lake Superior copper has been re-shipped to America, where prices are extraordinarily high; the advance in New York is from 18 to 27 cents.

TIN.—We have had a quiet tin market, but holders are very firm; some little business has been done in straits at £120. Banca nominally £123. The Dutch market is quiet at 73½f.; English unaltered.

TIN PLATES are decidedly better; first quality charcoal realize now 28s. in Liverpool, and coke according to quality from 22s. to 23s.

LEAD.—Since the government has removed the prohibition of the export of lead, some little business has been done and higher prices are now asked. Good English pig £20. 10s. up to £21; Spanish, 20s. In Liverpool business has been done in good English pig, £20. 5s.

SPELTER is quiet, but there are no pressing sellers in the market. We quote spot and in Hull £18. 5s.; forward, £18. 10s,; W.H., £18. 15s. A sale of 300 tons for March, April and May shipment was reported on Monday, at £18. 10s.

Metallic-Ore Markets.

TIN.—The standards for black tin are now reduced to

Refined	..	£111.
Common	..	£107.

Upon these prices, the *West Briton* remarks :—"This fall presses heavily on many of our tin mines, and very few of them will give any dividends under the present depression. Since the 1st of January, 1861, the standard has gone down £20, and the price of good common tin £12 to £14 per ton. The drop to a mine selling, as Carn Brea and some other tin mines, from 100 to 180 tons of tin in two months, will reduce their dividends £1,200 to £2,200 per two months, or about £7,000 to £13,000 per annum. There is not much hope of an improved price before our relations with America become more settled."

COPPER.—At the three Cornish sales we give this month, the average produce, price per ton and standard, have been as follows :—

	Produce.	*Price per Ton.*	*Standard.*
Jan. 2	7	£6 6 0	£128 1 0
„ 9	6¾	6 1 6	129 18 0
„ 23	5⅜	4 10 6	135 8 0

In our last number we pointed out the unmeaning nature of the imaginary average standard at present calculated, and the confusion which arises in endeavouring to arrive at any intelligible conclusion from it. In an extract we gave last month, from Dr. Percy's Metallurgy, the mode in which this imaginary standard is arrived at was clearly explained. In an extract we give this month, from the same work, our readers will be able to judge as to what are the real charges of returning copper from the ores, compared with the mythical charge upon the basis of which the standard is computed. If Sir W. Logan's formula can be taken as correct, we could easily establish a sliding scale of returning charges from which an approximating true standard might be computed. We shall be glad to have any suggestions on this subject.

In order to show the utter confusion to which the present system gives rise, we shall again point out the differences between the calculations of the *West Briton* and the *Mining Journal* as to how the price of ores have really gone :—

As to the sale of January 2nd, compared with that of the previous week, the *West Briton* states there was an advance of 17*s*., while according to the *Mining Journal* there was a decline of £1.

As to the sale of January 9th, they both agree as to there having been an advance of 18*s*.; but as to that of January 28th, the *Mining Journal* makes an advance of £1, while, according to the *West Briton*, there is a decline of the same amount. This, however, may be a clerical error in copying one from the other. Be this as it may, we think we have sufficiently shown how unmeaning and confusing the present system is.

LEAD.—Comparing the sales of the early part of the month with those of the same period of the former month, there appears another slight decline. In the latter part of the month, however, there seems to have been a rally, and, on the whole, lead ores seem to close this month at about the same rates as last month.

London Share-Market.

THROUGHOUT the month of December last, favourable anticipations were indulged in, relative to the pacific solution of the differences arising out of the *Trent* question, and numerous opinions were current, prophesying that an immediate and extensive demand for all kinds of metals would inevitably follow the realization of these most sanguine expectations, and that the mining market would thereby receive an impetus nearly equal to that which would naturally be experienced in the consols and railway markets. The events of the past month have, however, proved these conclusions to be delusive, and the large orders for metals which were then spoken of as certain, are yet in abeyance. It is therefore almost superfluous to add that the benefit derived by the mining market from the amicable adjustment of the difficulty, has been exceedingly partial in comparison with the hopeful views entertained at the close of 1861, and at the opening of 1862. From the great decrease in the exportation of copper, tin and lead, as shewn by the latest Government returns published, it is obvious that one of our great sources for the consumption of metals is still almost closed, and in all probability will remain so until the struggle which is now, unhappily, waging between the Northern and Southern States of America is brought to a termination; but there may be occasional spasmodic movements in regard to the demands for other continental markets, and this medium it is hoped will counteract the drawback of the American civil war, and eventually send forth the large and abundant orders, which are absolutely necessary for the purpose of restoring the metal market to its former state of activity and prosperity.

The continued ease observable in the money market, and the farther reduction in the Bank rate of discount to 2½ per cent., have materially tended to inspire confidence in the commercial community, and have had a most beneficial effect upon the markets; a large amount of money having already been withdrawn from the joint-stock banks, in order that it may be employed in more lucrative channels, and good, steady, dividend paying mines have thus eagerly been sought after for investment, and, in many instances, higher prices established.

The standard for copper ruled slightly higher at the beginning of January; but, at the sale on Thursday last, it again receded a little.

An improvement has taken place in the price of lead, which is most favourable for the lead districts.

The standard for tin remains unaltered, although a rise is generally looked for in the next week or two.

The following may be taken as the epitome of the Share Market for the month of January. Any important alterations that may occur after writing this will be found in the closing quotations, corrected up to the latest moment.

The dividend mines chiefly before the public during the month, have been:—Devon Consols, South Caradon, East Caradon, Marke Valley, Cook's Kitchen, Herodsfoot, North Downs, Providence, South Frances, West Caradon, Clifford Amalgamated, Wheal Margaret,

Wheal Seton, Wheal Mary Ann, Wheal Basset, East Basset, West Basset, South Tolgus, West Seton, St. Ives Consols, Carn Brea, Tamar Consols, and Craddock Moor.

Of progressive mines, East Carn Brea, North Treskerby, Great Fortune, New Seton, North Robert, Sartridge, Stray Park, West Polmear, West Rose Down, Wheal Edward, Wheal Uny, Wheal Grenville, East Grenville, Wheal Moyle, Wheal Trelawney, Wheal Arthur, Grambler and St. Aubyn, Pendeen, Wheal Unity, Long Rake, North Roskear, Wheal Grylls, Treloweth, Rosewarne United, Rosewall Hill and Ransom United, Bryn Gwiog, Carn Camborne, East Russell, South Carn Brea, Wheal Union, East Devon and Lady Bertha, have been dealt in. Devon Great Consols have become gradually firmer, and are now quoted 380—90; but it is very seldom that any shares are offered for sale, the general orders at present are to buy. The mine is reported as looking very favourable for farther discoveries, the usual two-monthly dividend declared at the end of this month (January) was £8 per share. South Caradon, after receding to 310 sellers, owing to a pressure of shares upon the market, have recovered, and seem at the moment very firm, with more buyers than sellers, whilst the quotation has advanced to 325-35: the next dividend is now about due. East Caradon shares improved as the time for holding the meeting drew nigh, and reached 30 buyers. The lode in the 50 fm. level east at this period was worth £90 to £100 per fm.; and the 60 fm. level east worth £50 per fm. This level is about 45 fathoms behind the working in the 50 fm. level. The new lode was reported worth £30 per fm.; and the rise in back of 60 fm. level was worth £80. A dividend of 15*s.* per share was declared, leaving a credit balance of £1,516. 14*s.* 7*d.* The prices farther advanced to 30¼ buyers ex. div., but have since declined and fluctuated between 28½ and 30; they close 29¾-30. Marke Valley rose to 10¼, with many orders to buy, but there was scarcely a share to be had on the market on the day of the meeting. The dividend expected was 5*s.*, and it was only at the last moment that the proprietors determined on declaring a dividend of 6*s.* per share, which caused a great demand for the shares, and transactions as high as 10⅜ ex. div. took place; the price is now 10 to ¼. The mine is looking well.

Cook's Kitchen are tolerably steady, at about 29 buyers; the dividend was 7*s.* per share, with a balance of £84. 7*s.* 4*d.* to credit of next account. Herodsfoot, after remaining rather quiet and dull at 37, have now improved to 38½-9½: the dividend is due early in February. North Downs opened at 4½-¾, and suddenly became in demand, and rose to 5¼ buyers. The drivage is resumed at the 60 fathom level, where an improvement is expected. The winze sinking below the 50 fathom level west is worth £30 for 6 feet; this is 15 fathoms in advance of the 60 end. Providence decidedly firmer, and in some request at present quotations 43-5. South Frances, after touching 115 buyers, have become a trifle weaker, owing to a predominance of sellers. West Caradon flat at 45-47.

Wheal Clifford Amalgamated slightly firmer at 29-31. The next meeting will be due in February, when it is expected the accounts will shew a credit balance of £2,500. Wheal Margaret shares have

been in request at higher prices, 44-6. Wheal Setons have been more free from the violent fluctuations which have marked them during the past two months; they close steady at 120-122. Wheal Mary Ann, steady and quiet at 16-17. Wheal Basset shares scarce; many enquirers, but very few shares offering; price 92½-7½. In East Basset very few transactions have to be recorded during the month; they remain stationary at 50-52½. This mine has some good chances of meeting with an improvement in a short time. West Basset inactive at 13-14.

South Tolgus have been frequently dealt in and close 54-6. West Setons much sought after, but no shares offering at fair market prices. St. Ives Consols occasionally inquired for at 26-27.

Carn Brea more in demand and close 70-75. Craddock Moor shares very scarce; at the 62 fathom level it is expected that Gilpin's lode will be intersected in a short time; price now 25-27. Tamar Consols became in demand owing to an improvement in the 237 fathom level, and rose to 2½; they close, however, weaker—1¾-2. East Carn Brea shares have shown great fluctuation during the month, having been as high as 11¼, and as low as 10½: they close rather firm at 10½-¾. North Treskerby considerably improved, having advanced from 18 to 28 on the discovery of a lode in the shaft worth £70 for 12 feet in length. Great Fortune shares have been eagerly bought up, owing to the more promising position of the Company; they close 13½-14: a dividend of 10*s.* per share was declared at the meeting. New Seton many buyers, but no shares on the market at present; mine looking well.

North Robert rather in request at 18*s.*-19*s.* Sortridge 9*s.* 6*d.*-10*s.* 6*d.*, sellers predominating. Stray Parks very steady for some time at 30-31, with a little business doing; they close weaker. West Polmear have changed hands as low as 5*s.* At the West Rose Down meeting a call of £1 per share was made; since this there has been a great demand for the shares at advanced prices—13-15, Wheal Edward not very much inquiry at 2-¼.

In Wheal Uny a large amount of business has been done; the ends, as well as north lode, are looking very promising; the shares are now steady at 5½-6. Wheal Grenville and East Grenville very flat; the latter have been sold as low as 26*s.* Wheal Trelawney is reported to be looking better; the shares are steady at 16-½. Wheal Arthur 14*s.*, 16*s.*, steady. Grambler and St. Aubyn again enquired for at 16-18. Pendeen, not many transactions. Wheal Unity 14*s.* to 16*s.*; the lode in the 85 has improved.

Longrake 13-15; the mine is looking well. North Roskear advanced to 26-28, but again receded, and closed 22-24. Wheal Grylls 13½-14½; shares have changed hands at 13⅞. Treloweth looking firmer; now quoted 1¼-½. Rosewarne United nominally quoted 16-17. Rosewall Hill and Ransom United have been largely dealt in, and improved to 3¼-¾. Bryn Gwiog 26½-7½; at the last meeting there was £268. 18*s.* 2*d.* in favour of the mine. Carn Camborne have been in request for the last few days at 11*s.*, 13*s.* East Russell very inactive at 2½-3. South Carn Brea very little business doing. Wheal Union in request at 2¼-¾. East Devon steady at 1¾-2. Lady Bertha dull; a call of 2*s.* per share was made at the meeting.

In the Stock Exchange a very large and active business has been transacted in the Foreign markets; St. John Del Rey shares having again been in extraordinary request, and advanced from 50 to 65 during the month; they close 63-65.

United Mexican have also been dealt in to a considerable extent, and have remained comparatively steady in price; closing 8¼-¾.

Scottish Australian in demand and risen to 1½. Cobre Copper steady at 34-36. Dun Mountain remain firmer at 1-⅛. Great Northern Copper weaker, par to ¼ premium. East Del Rey firmer at 1¾. Kapunda not much dealt in, 2-2¼. Linares, quiet and steady at 7¾-8¼. Port Phillip, 1-⅛, ⅜, ex dividend of 1*s.* 6*d.* per share. Bon Accord, business done at ⅝. Copiapo 6-7, with occasional dealings. Worthing, General Mines, North Rhine, Pontgibaud Silver Lead, Lusitanian and others, dull, with scarcely any enquiries.

Monday, 27th January, 1862. 4 P.M.

The following are the closing prices furnished by Webb and Geach, of the Stock Exchange, London:—

Markets generally active, with more buyers. East Basset, Wheal Basset, and North Basset in good request; North Treskerby rather flat; sellers of Clifford; Providence flatter; Carn Camborne firmer; buyers of South Caradon; South Tolgus, East Caradon, and Marke Valley dull; Wendron Consols and West Rose Down in request.

BRITISH.

Alfred Consols, ½ to ¾; Bryn Gwiog, 27 to 28; Camborne Vean, 1⅜ to ⅝; Carn Camborne, 12/. to 14/.; Copper Hill, 100 to 110; Cook's Kitchen, 29 to ½; East Devon, 1¾ to 2: East Basset, 51 to 53; East Caradon, 29½ to 30; East Carn Brea, 10¾ to 11; East Grenville, 26 to 28; Grambler and St. Aubyn, 16 to 18; Great Wheal Fortune, 13 to 14; Great Wheal Vor, 5¾ to 6¼; Herodsfoot, 38½ to 9½; Hingston Down, 2⅝ to ⅞; Billins, 18 to 20; Longrake, 13 to 14; Marke Valley, 10 to ½; New Seton, 60 to 65; North Downs, 5½; North Robert, 17 to 19; North Basset, 3⅛ to ⅜; North Roskear, 23 to 25; North Treskerby, 25 to 26; North Minera, 15/. to 17/6; Providence Mines, 43 to 45; Rosewall Hill, 3 to ½; Sortridge Consols 10/. to 11/.; South Phœnix, 10/. to 12/6; South Caradon, 320 to 330; South Frances, 110 to 115; South Tolgus, 54 to 56; Stray Park, 30 to 31; Tincryft, 7⅞ to 8⅛; Treloweth, 1⅜ to ⅝; Wendron Consols, 11 to 12; West Rose Down, 13 to 15; West Seton, 280 to 90; West Polmear, 3/. to 5/.; Wheal Basset, 90 to 95; Wheal Clifford, 28½ to 29½; Wheal Grenville, 30/. to 35/.; Wheal Ludcott, 2¼ to ½; Wheal Margaret, 43 to 45; Wheal Mary Ann, 16 to 17; Wheal Seton, 122 to 24; Wheal Trelawney, 18½ to 19½; Wheal Uny, 5¾ to 6.

FOREIGN.

Bon Accord, ½ to ⅝; Copiago, 6 to 7; Dun Mountain, par. to ⅛ pm.; East Del Rey, 1½ to ¾; Great Northern Copper, 1⅛ to ¼; Port Phillip, 1⅛ to ¼; Cobre Copper, 34 to 36; St. John del Rey, 64 to 66; Scottish Australian, 1⅜ to ⅝; United Mexican, 8½ to ¾.

Provincial Share Markets.

Dublin.—The following report is condensed from the *Mining Journal* :—In the early part of the month Wicklow Copper shares were freely taken at £53. 15*s*. Of speculative mines, General Mining Company for Ireland were most in favour, but could not command more than £5. 7*s*. 6*d*. per share. Connoree shares 31*s*. 6*d*. and 32*s*. Carysfort shares not in request. Further on in the month Wicklow Copper Mining Company shares advanced to £57, or a rise of £3. 5*s*. for the week—buyers; sellers looking for £57. 10*s*. In consequence of the favourable report issued by the Mining Company of Ireland of the prospects of their mines, and the state of their affairs generally, their shares made a smart upward move, and for two or three days were bought at £16, and £16. 5*s*., or an advance of 7*s*. 6*d*. A slight reaction then took place, prices receding to £15. 17*s*. 6*d*. General Mining Company for Ireland shares weak at £5. 7*s*. 6*d*. For Carysforts 4*s*. 6*d*. per share was offered, but no noticeable transactions took place. Connorree shares touched 33*s*. and receded to 32*s*., or a premium of 60 per cent. on 20*s*. paid up, demonstrating how much quotations of mine shares can be influenced by the capability of owners to hold out for a certain price, whether warranted or not by the prospects of the undertaking.

Still later, the quotations of Wicklow Copper shares were scarcely sustained, there being fewer purchasers. The Mining Company of Ireland shares were still quoted at £16. 5*s*.; but this being now marked ex-div., it is equal to £16. 13*s*. 9*d*. with dividend, or to a rise of 8*s*. 9*d*. per share on former prices. General Mining Company for Ireland shares showed weakness at last rates. Carysfort shares changed hands at 8*s*. 6*d*., sellers at 9*s*. Connorree shares are flat at 33*s*. Towards the end of the month, Wicklow Copper shares dropped from £56 to £53. 10*s*.; and Mining Company of Ireland shares went down to £15. 12*s*. 6*d*., sellers in both. On receipt of intelligence from London of an improvement in English funds, mine securities recovered somewhat from their depression, and Wicklow Copper shares were freely taken at £54. 7*s*. 6*d*., as have also Mining Company of Ireland shares at £16, ex. div. General Mining Company for Ireland shares are nominally £5. 5*s*. The quotation of Connorree shares continues at 33*s*. 6*d*., but no *bonâ fide* purchases have transpired; fresh investors would scarcely go beyond 20*s*. per share, or par. The revived attention to Carysfort shares somewhat subdued, for having been in demand at 8*s*. 6*d*. they were offered at 8*s*, each.

MINING REVIEWS.

The Progress of Mining in 1861; *being the Eighteenth Annual Review*. By Joseph Yelloly Watson, F.G.S. London: Published at the Mining Journal Office, 26, Fleet Street.

That Mr. Watson's Review has reached its eighteenth annual publication is the best possible evidence of the appreciation in which it is held by the mine-speculating public. As the head of a well-known and influential mine-broking firm, no one connected with the London market is in a better position to acquire accurate information, and to form correct judgments—leaving out of the question the facilities he possesses as City editor of an influential journal. Availing himself of all these advantages, and of a wide mining connection, Mr. Watson compiles annually a mass of information respecting all the mines possessing interest for market speculators, which does infinite credit to his industry and judgment.

From his position it is of course natural that Mr. Watson should look at mines principally in their market aspects, and dwell upon many intrinsi-

cally insignificant, but possessing an interest from being made a medium of speculation in the share-world. Not that by any means Mr. Watson confines his reviews to mere market concerns, for he includes, and gives valuable information upon, many which are rarely or never dealt in; and on the whole his Review gives the best body of information on the commercial position of Cornish, Devon, and Welsh Metallic Mining, in a compact compass, accessible to the public.

A Brief Review of the British and Foreign Mining Market for the Year 1861, *with Prices, Dividends, Ore Sales, &c., &c.* By Webb and Geach, of the Stock Exchange, and 8, Finch Lane, London.

Messrs. Webb and Geach have, in this Review, succeeded in giving us one of the most valuable contributions yet made to our knowledge of the market progress of mining affairs. Among the mass of publications issued by those connected with the London mining share-market, it is certainly remarkable that none have hitherto given us an Annual Review of the Market itself—a work which, above all others, they were capable of doing efficiently. Instead of doing so, they have given us contributions in abundance about mines, mining, and even the geology of mineral veins; upon subjects, in fact, upon which they were but indifferently acquainted, and respecting which they not unfrequently made the most palpable blunders.

Messrs. Webb and Geach, it seems to us, have taken the ground which, as brokers and members of the Stock Exchange, was the proper one to take. They do not write about mining, its technicalities, or its geology, upon which subjects their acquaintance must necessarily be limited; but give us a review of what they are masters of—that is, the market. Of this they give a series of monthly reviews—similar to that supplied in our pages—which together form a history of market progress which is not to be found in any other quarter. The statistics, too, are compiled with great care, and will be found invaluable for ready reference. We do not know where else they can be found in the same space.

Prices Current of Metals.

			Per Ton.		
IRON	Bars	in Wales	£5 2 6	@	£5 5 0
	,,	,, Liverpool	......		5 15 0
	,,	,, London	6 0 0	,,	6 5 0
	Nail Rods	,, Wales	5 12 6	,,	5 15 0
	,,	,, Liverpool	6 10 0	,,	7 5 0
	,,	,, London	7 5 0	,,	7 15 0
	Hoops (Staffordshire)	,, Liverpool	7 15 0	,,	8 10 0
	,, ,,	,, London	8 5 0	,,	8 15 0
	Sheets ,,	,, Liverpool	8 10 0	,,	9 5 0
	,, ,,	,, London	9 0 0	,,	9 15 0
	Bars ,,	,, Liverpool	7 0 0	,,	8 0 0
	,, ,,	,, London	7 10 0	,,	8 10 0
	Scotch Pig (No.1.g.m.b.)	the Clyde	2 8 6	,,	2 9 0
	Rails	in Wales.	5 0 0	,,	5 5 0
	Russian	C.C.N.D	......	,,	......
	Swedish—Hammered—large sizes		11 10 0	,,	11 15 0
	,, ,, Indian sizes		11 10 0	,,	11 15 0
STEEL	Hammered—faggot		......		16 10 0
	,, in kegs ½ and ⅜ in.		......		15 10 0
COPPER	Australian and other *fine* Foreign		102 0 0	,,	103 0 0
	Foreign Slab, for Prod. 96 per Cent.		91 0 0	,,	91 10 0
	English Tile and Tough		103 0 0	,,	107 10 0
	,, Best selected		105 10 0	,,	110 10 0
			Per lb.		
	,, Sheets, Sheathing and Rod		11½*d.*	,,	12*d.*
	,, Flat Bottoms		12*d.*	,,	12½*d.*
YELLOW METAL	Sheets, Sheathing and Rod		9*d.*	,,	10*d.*
			Per Cwt.		
TIN English	Common Blocks and Ingots		......		120*s.*
	,, Bars (in barrels)		......		121*s.*
	Refined		......		122*s.*
Foreign	Straits		119*s.*	,,	120*s.*
	Banca		123*s.*		124*s.*
			Per Box.		
TIN PLATES at Liverpool 6d. Less.	Charcoal IC		28*s.*	,,	29*s.*
	,, IX		34*s.*	,,	35*s.*
	Coke IC		22*s.*6*d.*	,,	23*s.*
	,, IX		28*s.*6*d.*	,,	29*s.*
			Per Ton.		
LEAD	Sheet		21 0 0	,,	21 5 0
	Pig—W.B.		......		21 10 0
	,, ordinary brands		20 10 0	,,	20 15 0
	,, Foreign, soft		19 10 0	,,	19 15 0
	Red		......		21 10 0
	Shot		......		23 0 0
	Dry White		......		27 0 0
SPELTER	(Cake)		£18 5 0	,,	18 10 0
ZINC	(Sheet)		23 10 0	,,	24 0 0
			Per Bottle.		
QUICKSILVER	(in bottles containing 75 lbs. each)		......		7 0 0
			Per Ton.		
REGULUS OF ANTIMONY, French Star			......		47 0 0

The transactions in Metals during the last week have been for the most part unimportant.

IRON.—*Scotch Pig* is easier; other sorts unchanged.

COPPER.—A slight reduction to note in *fine Foreign;* in *Chili Slab* business has been done at £91 to £91 10*s.* *English* without alteration, and demand slack.

TIN.—Rather more inquiry, and several parcels of *Straits* have been purchased at 119*s.* to 120*s.*, according to quality and prompt.

LEAD.—The permission to export has operated beneficially on this metal, and quotations show an advance of 10*s.* to 15*s.* per ton. The trade have purchased rather largely in the North, at £19 10*s.* to £20 for *Common*, and £22 for *Refined* Pig, usual terms.

SPELTER continues dull, and only sales of spring shipment are reported (250 tons), at £18 10*s.* per ton.

Copper Ores,

Sampled Dec. 18, and sold at Tabb's Hotel, Redruth, Jan. 2.

Mines.	Tons.	Purchasers.	Price.
l Amalgamated	109	9	£5 3 6
Wheal Clifford)	107	10	4 17 6
	105	4	5 2 0
	100	8	5 6 0
	88	4	7 16 6
	74	4	7 0 0
	68	11	5 1 0
	59	4	6 10 0
	28	6	15 15 6
	22	11	3 13 0
ston..................	94	8	8 8 0
	59	8	8 5 6
	56	11	2 15 0
	55	11	2 15 0
	52	8	8 8 0
	46	8	7 18 0
	44	3, 11	4 13 0
	43	4, 7	7 11 0
Roskear (Enys)	64	3	9 15 0
	53	2, 4	12 6 6
	24	3	2 16 0
(Basset)	40	4	4 6 6
(Pendarves)	37	4	3 8 6
	33	4	6 3 0
Tolgus	74	7	5 6 6
	71	7	8 13 6
	58	7	4 7 6
	47	7	13 15 6
Basset	82	2	5 13 6
	75	2	5 17 0
	45	2, 6	11 15 6

Mines.	Tons.	Purchasers.	Price.
Wheal Basset	30	2, 6	£12 6 0
South Frances	57	6	6 1 0
	49	6	5 6 0
	44	6	9 9 0
	36	7, 8	5 6 6
	15	6	2 2 0
Wheal Seton	9	7	5 4 0
(Pendarves)	65	7	6 9 0
	47	7	6 17 0
	38	3	4 15 0
	20	3	12 19 6
East Pool	60	10	4 15 0
	52	11	4 17 0
East Bassett	47	6	4 17 0
	30	8, 9	4 11 0
	26	10	0 3 6
Tolcarne	53	9, 11, 14	2 18 6
	37	11	5 17 6
North Crofty...............	43	8	4 12 6
	37	8	7 18 6
West Stray Park.........	56	6	7 17 0
Tresavean	55	8	1 19 6
Jackson's Ore	55	2	0 2 6
Wheal Uny..................	33	11	2 8 0
	16	10	7 10 0
Crane	28	8	7 16 0
Halse's Ore	9	2	0 0 6
	8	2	0 0 6
Wheal Harriett............	12	8	6 8 6
Wheal Kitty	9	6	8 14 6

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.
Amalgamated.........	760	4,606 14 0
heal Seton...............	449	2,912 10 6
loskear	251	1,847 2 0
Wheal Tolgus............	250	1,911 3 0
Basset......................	232	1,802 19 6
Wheal Frances.........	201	1,243 11 0
leton	179	1,228 0 0
ol...........................	112	537 4 0
eal Basset	103	603 0 0
)	90	372 8 0
North Crofty	80	492 2 0
West Stray Park..............	56	439 12 0
Tresavean	55	108 12 6
Jackson's Ore.....................	55	6 17 6
Wheal Uny	49	199 4 0
Crane	28	218 8 0
Halse's Ore........................	17	0 8 6
Wheal Harriett	12	77 2 0
Wheal Kitty	9	78 10 6

EACH COMPANY'S PURCHASE.

	Tons.	£ s. d.
Royal Co............	—	——
a and Sons............	293	1,687 9 0
ian and Co............	168	1,233 10 0
e Grenfell and Sons	484	3,117 4 3
a Copper Co.........	—	——
Willyams and Co..	342½	2,689 1 3
ms, Foster and Co.	410¾	2,957 6 6
a and Elkington...	559	3,668 7 0
9 F. Bankart & Sons........	141½	684 0 6
10 Copper Miners' Co.........	209	1,165 3 6
11 C. Lambert.................	362½	1,431 14 0
12 Newton, Keates & Co.....	—	——
13 Alkali Co..................	—	——
14 Sweetland Tuttle and Co	17½	51 13 6
	2,988	£18,685 9 0

ge produce, 7.
ity of fine Copper, 210 tons 2 cwt.

Average standard, £128 1s. 0d.
Average price per ton £6 6s. 0d.

Copper Ores,

Sampled Dec. 26, and sold at Tabb's Hotel, Redruth, Jan. 9.

Mines.	Tons.	Purchasers.	Price.		
West Basset	75	11	£4	18	0
	69	8	4	10	6
	64	10	4	8	0
	63	10	10	10	0
	62	1, 8	6	1	0
	59	10	7	6	6
	34	11	4	17	6
	30	8	9	15	6
	24	6,8,10	9	1	0
Carn Brea	75	10	4	6	0
	74	10	3	0	0
	67	4	10	7	6
	62	10	8	19	0
	59	10	3	5	0
	8	10	4	14	0
Alfred Consols	77	2	3	15	0
	59	2	1	10	0
	58	2	3	17	6
	56	2	12	6	0
	36	2	11	5	6
Par Consols	80	3,7	8	8	6
	76	4	10	2	6
	73	10	8	0	6
	34	4	8	16	0
	1	9	63	10	6
Wheal Margery	63	5,7	8	6	6
	55	6	3	14	6
	54	5,7	2	18	6
	51	7	2	14	6
	9	6	7	0	0
Tolvadden	52	14	3	4	6
	51	9	3	10	6
Tolvadden	47	3,8,11	7	8	6
	31	11	3	17	0
	5	8	20	3	0
Copper Hill	69	6	2	8	0
	43	8	7	2	6
	19	6	5	2	6
North Basset	42	5,7	4	12	6
	36	8	3	17	6
	29	8	6	15	0
Wheal Buller	66	3	3	12	6
	40	6	11	11	6
Wheal Agar	46	3	8	5	0
	26	5,7	6	7	6
	25	3	10	16	0
Wheal Alfred Consols	40	3,11	1	7	0
	20	9	4	12	0
	12	8	1	7	0
	11	3,8	1	12	0
	9	11	1	7	6
East Rosewarne	33	7	5	16	6
	27	7	9	1	6
	22	7	13	14	6
South Crenver	53	6	2	10	0
	9	6	8	4	0
West Trevelyan	24	6	7	6	0
	12	6	0	7	0
Treffry's Regulus	21	2,6	15	18	0
Clijan and Wentworth	17	8	2	18	6
Rosewarne Consols	10	3	8	19	0
	5	4	18	8	0
Wheal Union	13	8	4	5	0
Providence Mines	10	6	8	1	0

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.		
West Basset	480	£3,106	6	0
East Carn Brea	345	2,023	17	6
Alfred Consols	286	1,696	14	0
Par Consols	264	2,212	1	0
Wheal Margery	232	1,089	5	6
Tolvadden	186	916	11	0
Copper Hill	131	569	7	0
North Basset	107	529	10	0
Wheal Buller	106	702	5	0
Wheal Agar	97	815	5	0
West Alfred Consols	92	192	3	6
East Rosewarne	82	739	4	0
South Crenver	62	206	6	0
West Trevelyan	36	179	8	0
Treffry's Regulus	21	333	18	0
Clijah and Wentworth	17	49	14	6
Rosewarne Consols	15	181	10	0
Wheal Union	13	55	5	0
Providence Mines	10	80	10	0

EACH COMPANY'S PURCHASE.

		Tons.	Amount.		
1	Mines Royal	—	—		
2	Vivian and Sons	296½	1,863	13	0
3	Freeman and Co.	228 3¼	1,467	7	6
4	Grenfell and Sons	182	1,685	16	6
5	Crown Copper Company	92¾	521	4	3
6	Sims, Willyams and Co.	349¾	1,886	19	0
7	Williams, Foster & Co.	265½	1,736	7	9
8	Mason and Elkington	314 3¼	1,854	2	0
9	F. Bankart & Sons	72	325	6	0
10	Copper Miners' Compy.	545	3,368	5	0
11	Charles Lambert	184¾	808	6	0
12	Newton, Keates and Co.	—	—		
13	Alkali Company	—	—		
14	Sweetland and Co.	52	167	14	0
		3073	£15,679	1	0

Average produce, 6¾.
Quantity of fine Copper, 175 tons 7 cwts.

Average standard, £129 18s. 0d.
Average price per ton, £6 1s. 6d.

No Sale January 16th.

Copper Ores,

Sampled Jan. 8, and sold at the Royal Hotel, Truro, Jan. 23.

Mines	Tons.	Purchasers.	Price. £	s.	d.
Devon Great Consols...	119	11	£4	6	0
	115	5,7	3	19	6
	113	10	4	5	0
	110	3	3	14	0
	107	11	1	17	6
	103	7	3	0	6
	98	7,11	3	7	6
	95	3	5	9	0
	91	2	8	7	6
	89	11	1	15	0
	88	5,7	9	10	6
	84	5,7	3	14	6
	81	14	3	6	6
	78	5,7	3	14	6
	76	11	1	4	6
	67	11	3	6	0
	66	7	3	1	6
	65	3,11	1	19	6
	64	3,11	2	12	6
	57	7	4	14	0
	51	11	1	7	6
	50	8	8	8	0
	43	11	3	8	0
	41	11	3	4	0
	40	14	4	10	0
	39	7,8	4	19	0
	35	14	2	19	6
East Caradon	91	10	5	2	0
	82	6	10	14	0
	70	11	4	9	0
	68	6,10	8	10	6
	64	8	4	6	6
Hingston Down	85	4	5	6	0
	80	4	3	3	0
	70	4,7,10	3	8	6
	67	4	7	7	6
	61	7	3	3	6
Marke Valley	89	3	4	7	0
	88	2,7	4	1	6
	65	2,7	4	4	6
Marke Valley	61	7	£4	14	6
	57	7	4	19	6
Holmbush	109	6	2	3	6
	74	4	5	17	0
	73	6,8	13	10	6
	66	4	5	0	6
Lady Bertha	101	8	2	19	6
	85	8	2	19	6
	74	8	3	4	6
Bedford United...........	108	8,10,11	4	8	0
	101	7	5	16	6
East Russell	84	14	4	6	6
	68	4	6	2	0
	44	4	6	7	0
	5	4	18	15	0
Gunnis Lake (Clitters) .	78	5,7	5	6	0
	61	9,14	4	19	6
	53	9	4	15	6
Wheal Friendship	98	11	3	13	6
	58	2,7	11	6	6
Kelley Bray	80	8	3	18	6
	46	3	1	5	0
	20	10	5	11	6
Wheal Emma	55	7,11	4	4	0
	52	7	8	15	0
	33	11	2	7	0
Great Wheal Martha ...	76	2,6	2	12	0
	52	2,6	1	14	6
Okel Tor	68	2,3	2	14	6
	30	7	4	18	0
Wheal Crebor......	85	14	3	17	6
Molland	50	5,7	5	10	6
Brookwood	48	10	4	18	0
	2	10	19	10	0
Fursdon	20	14	2	5	6
	19	2	5	15	6
Hawkmcor..................	17	6	4	17	6
	13	11	4	9	6
Gawton	27	3	3	10	0

TOTAL PRODUCE AND VALUE.

	Tons.	Amount. £	s.	d.
Devon Great Consols	2065	£8175	15	0
East Caradon..................	375	2509	10	0
Hingston Down	363	1630	1	0
Marke Valley	360	1592	3	6
Holmbush	322	1988	19	0
Lady Bertha....................	260	792	0	0
Bedford United................	209	1063	10	6
East Rusell	201	1151	5	0
Gunnis Lake (Clitters)......	192	969	19	0
Wheal Friendship...........	156	1017	0	0
Kelley Bray.....................	146	£ 483	0	0
Wheal Emma..................	140	763	11	0
Great Wheal Martha.........	128	287	6	0
Okel Tor	98	332	6	0
Wheal Crebor	85	329	7	6
Molland...........................	50	276	5	0
Brookwood	50	274	4	0
Fursdon	39	155	4	6
Hawkmoor	30	141	1	0
Gawton	27	94	10	0

EACH COMPANY'S PURCHASE.

	Tons.	Amount. £	s.	d.
1 Mines Royal	—	£ ——		
2 Vivian and Sons.............	313¼	1753	3	9
3 Freeman and Co.............	465¼	1704	14	9
4 Grenfell and Sons..........	512¼	2829	0	10
5 Crown Copper Co...........	246¼	1294	4	3
6 Sims, Willyams & Co.......	342¼	2124	10	3
7 Williams, Foster & Co....	1059¼	5134	15	10
8 Mason and Elkington....	546	£2551	7	9
9 F. Bankart....................	83¼	404	16	3
10 Copper Miners' Co........	367¼	1858	4	4
11 Charles Lambert...........	984	2924	12	9
12 Newton, Keates & Co....	—	——		
13 Alkali Co. (Limited)......	—	——		
14 Sweetland and Co.........	375¼	1443	7	3
Total...........	5296	£24,022	18	0

Average Produce, 5¼.
Quantity of Fine Copper, 285 tons 0 cwts.

Average Standard, £135 8 0.
Average Price per ton, £4 10 6.

We cannot include the last Cornish sale of the month, as it does not take place until our day of publication, the 30th instant.

Copper Ores,

Sampled Dec. 18, and sold at Swansea, Jan. 7.

Mines.	Tons.	Pro-duce.	Pur-chasers.	Price.			Mines.	Tons.	Pro-duce.	Pur-chasers.	P
Cobre	96	12¼	7	£11	9	0	Cobre.............	50	21½	3	£19
	95	12¾	7	11	13	0		48	21¼	16	20
	86	12½	7	11	12	6		10	57¾	5	50
	69	12¾	2,3,6,7	11	15	0	Wheal Maria ...	57	34¼	1,10	32
	60	22¼	5	20	0	6		40	21½	2	19
	59	22½	3	20	1	0		36	24¾	1	23
	58	22¼	5	20	6	6	Ookip	44	34¾	3	32
	5	15¼	3	14	5	0	Union Ore	68	7	8	6
	12	57¾	5	53	0	0		63	7¾	12	6
	92	12	7	11	7	6	(Precipitate) ...	27	69¼	5	61
	91	11¾	6	11	8	0		27	69⅛	5	59
	90	11¾	3,6	11	8	0	Holyford.........	5	9¾	2	8
	89	12	6	11	2	0		1	8¾	2	7
	75	12¼	6	11	3	0	Spanish	5	12¼	16	11
	74	11¾	3	11	2	0		1	20	1	18
	51	21¾	2,3,7	19	17	0	Copper dross...	1	29¼	3	25

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.				Tons.	Amo
Cobre..............................	1250	£17,508	6	0	Holyford	6	£50
Wheal Maria	133	3,470	3	6	Spanish..........................	6	73
Ookip............................	44	1,419	0	0	Copper dross....................	1	25
Union Ore......................	185	4,132	1	6			

EACH COMPANY'S PURCHASE.

	Tons.	Amount.				Tons.	Amo
1 Copper Miners' Comp...	65¼	£1,770	10	3	8 Mines Royal Company	68	£42
2 Freeman and Co.	80¼	1,388	17	9	10 Mason and Elkington ...	28¼	91
3 P. Grenfell and Sons ...	312¾	5,562	14	9	12 C. Lambert	63	43
5 Sims, Willyams and Co.	194	6,787	10	6	16 Jennings & Co..............	53	1,01
6 Vivian and Sons	317¼	3,577	4	9			
7 Williams, Foster & Co...	403¾	4,792	6	9		1,585	£26,67

Copper Ores,

Sampled January 1, and Sold at Swansea, January 21.

Mines.	Tons.	Pro-duce.	Pur-chasers.	Price.			Mines.	Tons.	Pro-duce.	Pur-chasers.	P
Cuba	100	12¼	3	£11	1	0	Cuba...............	8	63¾	5,6	£59
	95	12¼	7	11	2	0		7	72¼	5	62
	90	12½	7	10	19	6		6	71½	6	62
	87	12½	3	11	0	6	Knockmahon..	94	14¼	7	13
	71	12	12	10	18	0		79	14¼	2,3,7	13
	58	15¾	1	13	18	0	Berehaven......	84	10¾	12	9
	3	70¼	5	58	12	0	Wheal Maria...	22	21¾	1	19
	85	12¼	2,7	10	18	6		11	21¾	1	19
	80	12	1,7	10	15	6	Ookip	8	33¾	1,5	31
	70	12¾	2,7	10	18	0	Turkish..........	15	14¾	12	13
	74	19¼	1,3	17	14	0	Tuscany.........	10	5¼	16	4
	65	20¾	1	17	18	6	New So. Wales	1	9¼	16	8
	55	20½	3,5	18	2	0		1	9¾	6	8
	38	20¼	6	17	18	0					

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.				Tons.	Am
Cobre	992	£13850	12	6	Ookip	8	£248
Knockmahon	173	2274	19	0	Turkish	15	195
Berehaven	84	783	6	0	Tuscany..........................	10	40
Wheal Maria.................	33	649	16	6	New South Wales	2	16

EACH COMPANY'S PURCHASE.

	Tons.	Amount.				Tons.	Am
1 Copper Miners' Co.......	237	£3831	1	0	7 Williams, Foster & Co.	422 5-6	£4901
2 Freeman and Co.........	103 5-6	1192	1	11	12 Charles Lambert.........	170	1752
3 P. Grenfell and Sons...	277 5-6	3563	2	2	16 Jennings & Co............	11	46
5 Sims, Willyams & Co.	45½	1470	16	0			
6 Vivian and Sons.........	49	1299	3	0	Total...........	1317	£18,058

Black Tin Sales.

Date.	Mines.	Tons c. q. lbs.	Price per ton. £ s. d.	Purchasers.	Amount of Money. £ s. d.
Dec. 21.	Garlidna	5 13 0 6	71 10 0	Bissoe	478 18 11
,,	,,	1 4 3 20	60 0 0	Ditto	
,, ,,	North Roskear	6 15 3 9	67 0 0	Mellanear	455 0 6
,, 28.	Drake Walls	3 10 0 0	70 12 6	Daubuz & Co.	1293 17 6
	,,	3 10 0 0	70 12 6	Bissoe Co	
	,,	6 0 0 0	66 12 6	Daubuz & Co.	
	,,	6 0 0 0	66 12 6	Bissoe Co	
Jan. 2.	Gurlyn	4 16 2 20	65 0 0	Chyandour	314 4 0
,, 12.	Wheal Kitty	4 11 2 15	62 10 0	Trethellan	559 18 11
,, 11.	,,	4 7 2 5	62 10 0	Ditto	
,, 10.	Penhalls	2 10 1 24	67 5 0	Trethellan	343 13 10
,, 11.	,,	2 11 3 0	67 5 0	Bissoe	
,, 14.	Great Wheal Vor	20 7 2 22	—	—	1477 12 3

Tin ores being sold by private contract, the particulars are not generally published or accessible. We hope, however, to be able to provide monthly a tolerably complete list of the sales of this metallic ore: the above list gives no idea of the real sales.

Sundry Copper Ore Sales.

Sold by Mr. James Lewis, at Liverpool, from Laxey Mine.

Date.		Tons.	Price per ton. £ s. d.	Purchasers.	Amount of Money. £ s. d.
Jan. 3.	Lot 1 (ex *Jane & Agnes*)	62	4 8 0	Newton, Keates & Co	693 0 0
,, 9.	2 (ex *Ruby*)	38	4 15 6	Ditto	
	Sold at Liverpool, by Mr. J. Pitcairn Campbell.				
,, 21.	Lot 1 (*Reveral*)	30	3 14 6	C. Lambert	829 19 10¼
	2 (*Coila*)	32	3 14 6	ditto	
	3 (ditto)	13	7 0 0	ditto	
	4 (*Lisette*)	30	3 10 0	ditto	
	5 (ditto)	5	7 1 9	J. Keys & Son	
	6 (*Chanarcello*)	5	24 11 6	Vivian & Sons	
	7 (ditto)	2½	29 15 0	ditto	
	8 (ditto)	4¼	28 14 6	ditto	
	9 (ditto)	1½	32 1 6	ditto	
	Sold by the Parys Mines Company.				
,, ,,	Lot 1	225	5 13 6	C. Lambert	1440 0 0
	2	75	2 15 6	ditto	

Blende Sales.

Date.	Mines.	Tons.	Price per ton. £ s. d.	Purchasers.	Amount of Money. £ s. d.
Dec. 30.	Great Retallack	460	1 4 0	Vivian & Sons	552 0 0
,, 31.	Minera Mining Co.	80	2 0 0	Kenrick Wright Courage	729 14 0
	,,	80	2 5 0	Courage & Co.	
	,,	106	3 3 0	Vivian & Sons	
	,,	24	2 6 6	Courage & Co	

Lead Ore Sales.

Dates.		Mines.	Tons.	Price per Ton £	s.	d.	Purchasers.	Amount of Money. £	s.	d.
Dec.	27.	Isle of Man Mining Co.'y.	100	14	0	0	——	1400	0	0
,,	28.	Wheal Mary Ann	60	24	10	6	Stock & Co.	1471	10	0
,,	31.	Minera	100	12	10	6	Walker, Parker & Co.	4823	15	0
		,,	100	12	11	0	ditto			
		,,	40	12	7	6	ditto			
		,,	100	12	10	0	ditto			
		,,	30	12	7	6	ditto			
		North Minera	20	11	16	0	ditto	236	0	0
Jan.	1.	Dyliffe	65	12	6	6	Newton, Keates and Co.	1607	2	6
		,,	65	12	8	0	A. Eyton			
		Llanerchyraur	49	13	8	6	Walker, Parker and Co.	657	16	6
		Dyfngwm	55½	12	0	0	Newton, Keates and Co.	1082	10	0
		,,	35½	11	18	0	ditto			
		Rhoswydol	18½	11	6	6	Walker, Parker & Co.	313	9	3
		,,	9	11	11	0	ditto			
		Aberdovey	7½	11	17	6	ditto	184	1	3
		,,	7½	11	17	6	Newton, Keates & Co.			
		Yralltwen	3½	11	13	0	A. Eyton	43	13	9
,,	3.	Exmouth	80	10	0	0	Stock and Co.	800	0	0
		Wheal Frank Mills	65	15	12	6	Treffry's Trustees	1641	17	6
		,,	50	12	10	6	ditto			
		Penpompren	20	12	19	0	Sims, Willyams and Co.	259	0	0
,,	6.	East Logylas	80	11	16	0	Panther Company	944	0	0
		Cwmystwith	120	12	0	0	ditto	1440	0	0
		Glogfach	65	15	10	0	Sims, Willyams and Co.	1007	10	0
,,	7.	Llanfair	25	25	15	6	Treffry's Trustees	744	7	6
		Talargoch (Maesyrerwddu)	36½	12	16	6	Walker, Parker & Co.	962	2	3
		,, (Coetia Llys)	38	13	0	0	Newton, Keates & Co.			
		Deep Level	20	12	5	0	ditto	245	0	0
		Brynford Hall	5	12	0	0	A. Courage and Co.	60	0	0
		Herward United	10	11	3	6	Walker, Parker & Co.	111	15	0
		Rhosesmor	72	12	5	6	ditto	907	16	0
		Orsedd	11	12	8	6	ditto	136	13	6
		Parry's Mine	30	12	5	6	ditto	368	5	0
		Bryn Gwiog	30	12	13	0	A. Eyton	379	10	0
		Long Rake	15	12	11	0	ditto	188	5	0
		Pwllmelyn	4	8	1	0	Newton, Keates and Co.	32	4	0
		Holywell Level	10	13	13	6	A. Eyton	136	15	0
		Dylife	60	12	5	6	ditto	736	10	0
,,	10.	Cargoll	63	14	2	6	R. Michell & Son	889	17	6
,,	11.	Keswick	25	12	3	0	W. J. Cookson and Co.	303	15	0
,,	20.	Frongoch	130	12	4	0	Sims, Willyams and Co.	1586	0	0
		Gwaith Coch	15	11	2	0	ditto	333	0	0
		,,	15	11	2	0	Panther Company			
		East Darren	72	15	9	0	Sims, Willyams & Co.	1112	8	0
		Cwm Erfin	35	15	5	6	Treffy's Executors	834	12	6
		,,	20	15	0	0	Panther Company			
,,	23.	Westminster	50	12	1	0	Walker, Parker and Co.	602	10	0
		Mount Pleasant	25	12	5	6	ditto	513	10	0
		,,	7½	13	15	6	ditto			
		,,	7½	13	15	0	Newton, Keates & Co.			
		Hendre Ucha	13	12	3	6	Walker, Parker and Coo.	158	5	6
		Pool Park	14	12	3	6	Newton, Keates and Co.	170	9	0
		Dyliffe	70	12	10	6	Walker, Parker & Co.	876	15	0
		Roman Gravels	30	12	7	6	ditto	371	5	0
		Llangynog	20	12	2	6	Newton, Keates and Co.	242	10	0
		St. Pierre de Peona	20	4	1	0	ditto	327	2	6
		,,	35	5	17	6	ditto			

THE

MINING AND SMELTING MAGAZINE.

MARCH, 1862.

The Miners' Association of Cornwall and Devon.

BY ROBERT HUNT, F.R.S.,
Keeper of the Mining Records.

THE second general meeting of the Miners' Association of Cornwall and Devon has recently been held at Redruth. The council's report, and the supplementary reports of the educational and the financial secretaries, have been made. The public, therefore, who may be interested in this the most recent experiment in the way of giving a technical education to the miners, have the means of judging of the prospects of the Association becoming a permanent institution.

There is certainly much that is encouraging in the results obtained during the past year. One hundred and thirty persons, more or less connected with the mining operations of Cornwall, have been receiving instruction in chemistry, mineralogy and mechanics. A considerable number of these, considering all the circumstances of their position, passed with great credit the examinations of the Department of Science and Art, securing many of the best prizes which the Government offered. If the ability and the industry of an individual is to be judged of by the result of a public examination, then the young Cornish miner has shown considerable industry and great aptitude in acquiring knowledge. I am not, however, prepared to adopt this test as a conclusive one. These very examinations have forced on me the conviction that more than the average amount of intelligence existed amongst those young men who did not "pass" in the examinations of last May.

Minds vary infinitely in their conditions, these conditions being greatly dependent on the physical state of the individual. An examination is necessarily confined to a few hours, and within that time a nervously excitable or a timid man may be quite unable to collect his thoughts sufficiently to gather together the fragments of knowledge which are, as it were, scattered in his mind.

Let those, therefore, who did not succeed at the last examination "take hope again," and let not the enquirer suppose that the aptitude for knowledge was represented by the numbers—though these were

respectable—who did pass the peculiar examination of this division of the Education Board.

Enough has been done by the Association to show how much more may be done, if its machinery can be extended and its sphere of operations enlarged.

The one discouraging feature, which must not be disguised, is shown in the financial report. The expenditure has exceeded the income. This the financial officer endeavours to explain, or excuse, on the plea that large stores of chemicals, of apparatus, of books, and of materials for drawing have been purchased; and that these things are so much property acquired by the Association.

This is true; but seeing that nearly one-half the cost of these things has been defrayed from the "grant in aid" of the Department of Science and Art, it ought not to have happened that at the end of the first year of its operations the miners of Cornwall allowed an Association, *professedly at least*, working for the improvement of the mining interests, to find itself in debt.

It is, however, pleasing to record, that nearly one-half of the debt has been paid off since the general meeting; and that additional support is promised from mines and from individuals connected with mining.

The great question which the mining interest must consider, not cursorily, but deeply and thoughtfully, is, will the Association, if it can carry out its objects, produce any real improvement in the art of mining? or will the commercial advantages which we may expect to arise from increased knowledge, give us interest for the money which we may expend on the machinery necessary for imparting that knowledge?

Let us endeavour to take a fair and impartial view of this problem, standing on neutral ground, and fearlessly examining the merits and the demerits of the arguments which have been brought forward as answers to this, in every way, interesting question.

Mining has unquestionably been prosecuted for a long series of years by men who have not possessed any of the advantages which are supposed to be derived from education. That is, the miners as a class have not received the knowledge which is imparted by scholastic training. Their school has been experience—the experience bought by hard-handed toil—and by that peculiar kind of observing-faculty which is called into play by the system under which they work. This being the case, and seeing that the produce of our metalliferous mines has been steadily increasing with the demands, why, it may be asked, is it necessary to interfere with the existing order of things? Why trouble the miner with the acquirement of knowledge which his father did not appear to require, and without which he has hitherto earned his daily bread?

On the answer to these questions depends the propriety or otherwise of supporting the Miners' Association. The answers must therefore be clearly given.

As the questions have been put, there is one omission which bears importantly on the case. Mining has not gone on without the introduction of knowledge, of a new and extraordinary character, amongst our miners from time to time.

In the reign of Elizabeth the mining operations of England had fallen to so low a state, that the Queen, by the advice of her council, sent for several German miners, and offered them special privileges for introducing new and improved methods of mining into this country. These German miners worked the mines on the banks of the Tamar, and became so intimately connected with the mines of Cornwall, that we find one of them Vice-Warden of the Stannaries for many years.

Again, in 1783, mining in Cornwall was pursued under the utmost disadvantage, owing to the imperfections of the engineering. How instructive on this head is the following letter from Watt to Boulton:—

"Chacewater Company sunk £50,000 and upwards in setting that mine to work, and whether they have recovered it all yet seems uncertain, although the mine has been tolerably prosperous.

"Wheal Virgin Co. lost £28,000 in ten months' unprosperous working. Poldice has sunk a very great sum, and is not now gaining nor saving. It has cost £35,000 to fit up and drain Wheal Virgin in this working, and it costs above £10,000 a year to draw the water after all that can be done for them. Roskeer has been long languishing, and does not now pay costs. At Dolcoath Mine it is said they use £500 of timber per month, and a new kibble rope of above a ton weight is worn out in a fortnight. It takes full fifteen minutes to draw a kibble of ore there, which weighs only about 3 cwt. On the average, above two-thirds of the stuff drawn is barren stones. It cost three years' work, and, I believe, as many thousand pounds, to sink a new shaft in that mine: every fathom of an engine-shaft that is sunk under the engine costs from £50 to £100.

"United Mines have been at death's door, and are still in a tottering state. Wheal Union adventurers, after working nearly three years, were glad to sit down with a loss of £7,000 or £8,000. If we had not furnished them with more effectual means of drawing the water, I believe almost all the deep mines had been abandoned before now."

No one will deny the advantages which were derived from the introduction of improved machinery into Cornwall. Few will be prepared to deny the advantages of the competition which existed for many years amongst the engineers of the county, which raised the pumping engines of the West to the highest pitch of excellence, and which made the engine-houses of the Cornish mines patterns to the world for their order and cleanliness.

Other cases might be cited to prove, that, beyond the force of human muscle, the powers of the cultivated mind were being continually called into action to produce the results which we obtain from our mineral explorations.

For 3,000 years man has been working the rocks for the sake of their mineral treasures. The consequence is, that the riches which existed near the surface are nearly all gone, and it is only by plunging deeper into the earth that we can hope to maintain the supply up to the demand.

To do this with economy we must still improve our pumping and winding machinery. We must devise methods by which the labour of climbing shall cease; and the ventilation, which may now be

sufficient, will shortly become inadequate to the vital wants of the miner. Every process, if we would be successful, must be carried out in the best methods. Holes must be placed in the most favourable positions in relation to the jointed structure of the rocks. The whole power of the explosive agent must be brought to bear, without waste, with the maximum of force, on the mass to be moved.

One of our most celebrated agents recently stated that the greatest number of accidents in mines arose from the want of knowledge amongst the men of the strength of materials, and the best form of applying mechanical powers.

Dressing arrangements must still be improved. There are losses which ought not to arise, and which might be prevented by a careful study of the laws of fluid motion, and of gravitating power.

Mineralogy is allowed by all to be a want, and the means of detecting minerals a necessity. Therefore it is not expedient to extend the reply, by which we hope to prove that Mechanics, Mineralogy, including as much of Geology as deals with the structure of the older rocks, and Chemistry, in its application to Metallurgy, are branches of scientific education which should be offered to the miners at such a cost and with such conveniences that they can have no excuse if they do not profit by them.

The Miners' Association started with the following resolution, moved by Captain Charles Thomas, and supported by Mr. Charles Fox:—

"That this meeting approves of the formation of a society to be called the 'Miners' Association of Cornwall and Devonshire,' which shall devote itself to the encouragement and advancement of mining and mine engineering—promote the exchange of information and ideas—secure the record of the results of experience and observation—devise plans for the education of the practical miner in the branches of science which bear immediately on mining—establish local collections which should illustrate the geology, mineralogy and physical phenomena of each district—and by all available methods aim at the improvement of the great mining interests of Western England."

Let it not be forgotten that the aim of the Association is to offer that real knowledge which will be directly applied by the miner to his bread-getting. That by securing the attention of the miner to the advantages to be derived from certain branches of science a substantial benefit must be conferred on every man possessing mining property in the form of land or in the shape of shares.

The experience of the past year is of that character which creates a determination on the part of all the promoters of the scheme to work zealously towards the end indicated, and to wait patiently the result of their carefully directed zeal.

"All noble growths are slow," was the fine remark of Channing. The council of the Association desire to extend their operations, but, at the same time, they are endeavouring to consolidate the institution. At the last meeting the machinery was simplified, while the useful working power was increased. They feel with Addison's Cato that—

> "It is not in mortals to command success,
> But we'll do more, Sempronius, we'll deserve it."

The Burnley Coal-Field, Lancashire.

By Edward Hull, B.A., F.G.S.,
Of the Geological Survey of Great Britain.

The description of the coal-fields of Lancashire and Cheshire presented in the last number of this periodical would be incomplete, were we to omit a more special reference to the coal-basin of Burnley than it was in our power to give on that occasion.

On referring to the map which accompanies that description it will be observed that to the north of the darkly-shaded portion, which represents the richly-stored coal-tracts, there stretches a broken and indented region of Millstone Grit and lower Coal-measures. Now this region is not altogether barren of mineral fuel, but contains, throughout a vertical thickness of some four thousand feet of strata, several good coal-seams.* They are, however, never very thick, seldom reaching three feet. One or more of these seams, classed under the appropriate, though rather indefinite, name of "Mountain Mines," is worked over wide areas of moorland, occupying the central portion of South Lancashire and stretching into Yorkshire. Some of the coal-works amongst the Lancashire hills are of very rude and primitive construction—probably little changed for the last three or four centuries. In some places the seams crop out along the flanks of the hills, and are entered by tunnels or "day eyes,"—a miner's term, which any one who has crept or scrambled through one of these dark and low passages for a time, and at length caught a glimpse of the small distant opening into daylight will recognize as very expressive. In other spots, as amongst the hills north of Staleybridge, the seam is entered at the outcrop, and is tunnelled in the direction of the dip, or as it is termed "down-brow," to a surprising distance. The coal-trucks are hauled up the steep incline by a stationary engine planted in front of the entrance to the mine. In another instance, north of Rochdale, water power is employed. By an ingenious contrivance an over-shot wheel is made to raise the coal through the vertical shaft; but when not used for this purpose, the power is transferred, by means of a long lever, to a pump for draining the mine, and the whole process is managed by one banks-man. The hand-gin and the horse-gin are also here seen—monuments of a period when the power of steam was unknown, but which, like the different styles of architecture in ancient buildings, recall to our imagination the progressive stages of mining art in days gone by. They are, however, seldom employed, as in even very small concerns a dwarfish steam-engine is preferred, both for its economy and greater convenience. Some of the engines are of such diminutive size as to seem fitted only for playthings, and their utmost efforts are required to lift a single man, or a small "skip" of coal, to the surface from a depth of a few feet or yards.

Of the far-extending breadth of coal-strata which at one time overspread the hills of shale, grit, and conglomerate, lying to the north of

* See *Mining and Smelting Magazine*, No. 2. p. 87.

the Lancashire coal-field, the Burnley coal basin forms a small, but valuable remnant. It occupies a broad valley nearly enclosed by high and steep hills, and in its centre stands the newly incorporated town of Burnley. The hills which rise on either side are formed of Millstone Grit and lower Coal-measures (see fig. 1) which have been upheaved on the eastern side along the line of a great fault, beyond which the strata are nearly horizontal, and form a table-land, from whose centre rises a knoll containing a small outlier of the *Arley Mine.* On the opposite or western side of the basin, the strata rise and outcrop in rapid succession, and may be traced by the aid of many beautiful sections across Padiham Heights, Pendle Hill, down to the Carboniferous limestone of Clithero. At Burnley, the centre of the basin, the strata lie nearly horizontal, but are traversed by several faults. The northern edge of the middle coal-series is not, I believe, very accurately determined.*

The following are the series of coals at Burnley, near the centre of the basin, from the top downwards. The *Doghole* or *Top Mine*, 6 feet thick; the *Kershaw Coal*, 3 feet; *Shell Coal*, 2½ feet; the *Burnley Old*, or *Main Coal*, 5 feet; the *Maiden* or *Higher Yard*, 3 feet; the *Lower Yard* or *Four Feet*, 4 feet; Impure Cannel, 2¼ feet; *Thin Coal*, 2¾ feet; *Great Mine*, 4 feet, divided into two seams by a parting of shale. The above constitute the "Burnley top beds." They include about 36 feet of workable coal, distributed throughout 580 feet of strata; and below the *Great Mine* there are 200 feet of strata destitute of coal. Next underneath is found the Habergham series, consisting of the following coals in descending order: *China Bed*, 2 feet thick; *Dandy Bed*, 2 feet; *Fulledge Main* coal, or *Arley Mine*, 4 feet in thickness. This last, named after its supposed representative in the Wigan and Bolton districts, is the lowest seam of the middle Coal-measures. After reaching this well-defined geological horizon, we have to pass through 200 yards of strata or more (for the real depth has not been actually proved) before reaching the thin seams belonging to the Lower Coal-measures, or Gannister series. These, as stated by Mr. Whittaker, are as follows:—*Foot Mine*, with a hard gannister floor; the *Spa Clough Top Bed*, two feet and a half thick; *Spa Clough Bottom Bed*, four feet in thickness. At some distance, about a hundred yards underneath this last, is the Millstone Grit, with two or three thin seams which outcrop in the road near Height House.

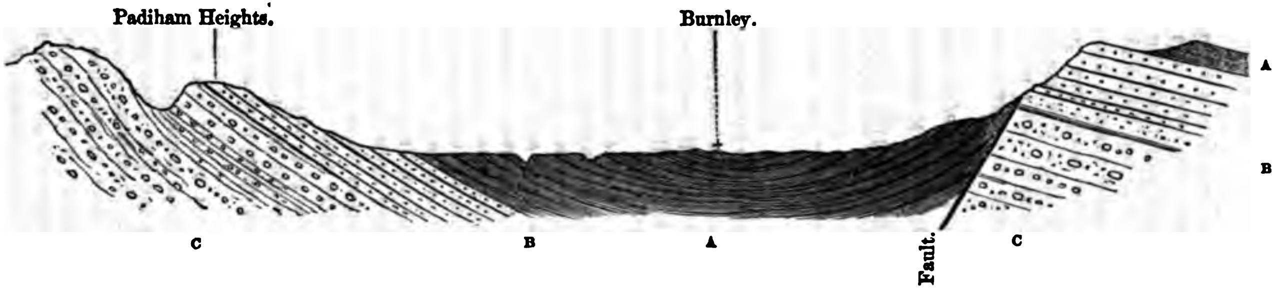
To sum up the above in a few words, the upper Coal-measures have been removed by denudation, which has also carried away a large portion of the middle series. This latter is about 1,020 feet in thickness, with 13 workable Coal-seams, containing about 40 feet of coal. The lower Coal-measures, which are from 1,200 feet to 1,500 feet in thickness, contain about 6 feet of workable coal divided amongst two beds.

The gannister rock of this district is a very marked feature in the series. It forms the floor of one or more seams, and instead of

* An interesting account of the formations of this district, with their animal and vegetable remains, was presented, by Mr. J. Whittaker, at the meeting of the British Association at Manchester, 1861, and is published in the "Geologist Magazine," vol. iv., p. 508.

FIG. 1.

SECTION ACROSS THE BURNLEY COAL-FIELD.



A. Middle Coal-measures, with thick Coal-seams down to the *Arley Mine*.
B. Lower Coal-measures, or Gannister Beds, with their Coal-seams.
C. Millstone Grit, from the "rough-rock" downwards.

assuming the usual character of *under-clay*, appears as a very hard compact silicious stone. It is sometimes four or five feet in thickness, and along Padiham Heights is in high requisition as a road material. It is in fact the hardest stone of the neighbourhood, only surpassed in this quality by the Carboniferous limestone of Clithero, and when struck by the hammer causes it to ring. Nevertheless it is a true under-clay or seat-stone; is penetrated in all directions by *Stigmaria ficides* (the roots of *Sigillaria*,) and has in all probability become indurated by the gradual infiltration of silex in solution. Indeed we may feel confident that it was not in its present state when the coal plants were rooted into it.

The area of the Burnley coal-basin is about twenty square miles. It contains a very large supply of mineral fuel for future use; probably enough to last for nearly 300 years at the present rate of production. Indeed it is only very recently that its true value has been thoroughly appreciated, as an impression had prevailed amongst the old miners that the coal-seams, along whose outcrop they and their forefathers had been working for generations, did not extend in the direction of the centre of the basin. A fuller light, the result partly of the spread of scientific knowledge, has dispelled this illusion, and the inferences which were fairly to be adduced from the structure of the strata and the margin of the basin, have been verified by actual experiment. It is now fully understood to be a true basin or trough, and the complete series of coal, as given above, has been satisfactorily ascertained by sinking at Burnley.

This district is also noteworthy as the residence of a goodly band of observers of natural phenomena, led and encouraged by Sir J. Kay-Shuttleworth, of Gawthorpe Hall, and it is not the least pleasing fact in connection with the subject, that amongst them may be reckoned several miners and working men, whose knowledge of the palæontology of the Carboniferous rocks would do credit to many who have had the advantage of superior education.

On the Mexican Method of Amalgamation.

By James Napier, Jun., F.C.S.

Late Chemist and Assayer to the Guanaxuato Mint, Mexico.

§ II.—GRINDING ORES AND SEPARATING THE GOLD.

In the introductory section I gave a brief sketch of the history of the Patio amalgamation process, and a few analyses shewing the general composition of some of the silver ores in certain of the Mexican mining districts. In the present section I propose describing the methods employed for grinding the ores and separating the gold; it being understood that my description refers particularly to the district of Guanaxuato. As the mode in which the sales of the ores are conducted is characteristic, I may be permitted to give a prefatory notice of it.

Sales of Ores.—Some of the poorer mines of Guanaxuato are worked by what are called "*Buscones*" (searchers). These are miners

answering to the Cornish "tributers," who work without any definite pay, but receive half of the value of the produce they extract from the mine. At stated times a sale takes place at each concern, when these *buscones* arrange in separate lots whatever they may have extracted since the previous sale, in the court-yard of the mine. These lots of ore are cunningly laid out, so as to expose the richest portions to the view, some shewing much taste in their arrangement; and each miner stands near his own lot and keeps it constantly sprinkled with water, which has the effect of making the mineral look darker and richer.

The various "*Rescatadores*" (purchasers) take from each lot a small portion of ore, as average a sample as possible, which they have finely ground, and tried or assayed on the spot. This is done by placing about a handful of the ground ore in a "*Jicara* *" or small round bowl, washing away the whole of the earthy particles, and judging from the metallic portion remaining of the richness of the ore. It is really astonishing to mark how by this rude process those who constantly practise it are able to arrive at results so near the truth. However, many purchasers have assays now also made by fire for greater accuracy, and in this case the samples are obtained the day before the sale. These assays are either made by scorification, or by smelting the mineral with red lead, crude carbonate of soda, a little charcoal and salt, and cupelling the resulting buttern of lead.

At the regulated hour for the sale a bell strikes, as a signal that it is about to commence. The person intrusted with the sale takes his place successively at the foot of each lot, and every buyer in turn whispers into his ear what he wishes to give for that parcel. When all have given in a price the lot is called over to the highest bidder, the rate of his bid being named; where two buyers bid the same amount, the first bidder gets the preference. The person acting as auctioneer and the rescatadores thus move from lot to lot till the whole of the ore in the yard has been disposed of. The weight of these lots of ore is not ascertained by weighing, but has to be judged of by eye. This, like the trying of the ore, is accomplished by those who have had long practice with remarkable accuracy; and, on the whole, one of these sales is rather exciting. The moment a lot of ore is called out to a buyer, the miner has nothing more to do with it; the purchaser having to remove it from the ore yard to his reduction works, or *Haciendas*. This is usually done packed in sacks on mules' backs; the ore, if in very large lumps, as it often is, being previously

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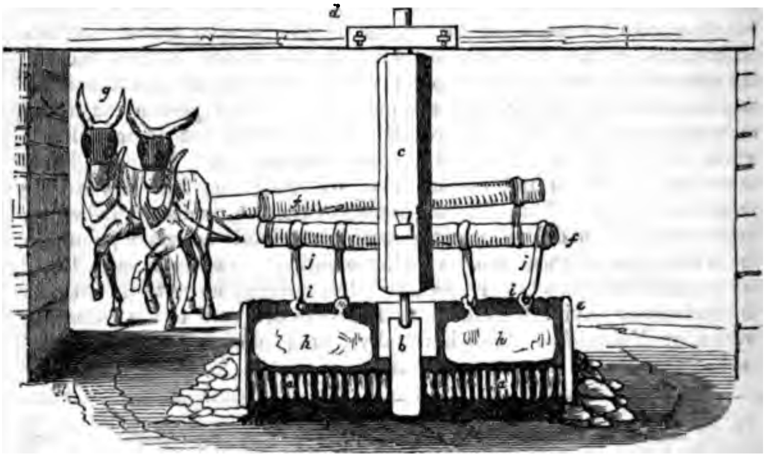
* Of these vessels Sonneschmidt has the following interesting remarks. "There is a tree which is found in some parts of the coast of this kingdom, (New Spain), which produces a round or spherical fruit of various sizes; they clean out this in the middle, and take away the pulp which it contains, when two cups called '*Jicaras*" or "*Chacules*," are taken out. Those employed for the purpose of assaying are about 7 or 7½ inches (Spanish) in diameter, and 3 or 3½ in depth. In the village of "*Olinalan*," where the Indians occupy themselves in the manufacture of these vessels, they are coloured inside and out with varnish and colour, and at times they have figures on their exterior. Besides being used for the above purpose of assaying, they are also used for domestic purposes, being found in almost every habitation. For this purpose it matters not what size or colour they are; but for the purpose of assaying they should be black or blue inside, because the red and green deceive the eye."

broken into moderately sized pieces. Each sack holds about 175lbs., and two of them are loaded on each mule.

Rough Stamping.—The first operation to which these ores are subjected is a coarse stamping. This process is carried out in what are termed "*morteros*" or "*molinos*," which are very similar to the stamps used at the Cornish tin mines. The extent of these *morteros*, or the number of heads, naturally depends on the extent of the "*Hacienda*," and they are worked by mule power, excepting in a few districts, where steam or water is employed. The ore, as it is fed to the stamps, is in pieces about the size of the fist; as it is stamped, it falls into a piece of strong hide, perforated with small holes, and fixed in an inclined position. What does not pass through the holes is again returned to the stamps, whilst the finer portion, called "*Granza*," a very coarse sand, is conveyed to the "*arrastres*" or fine grinding mills. One stamping mill or battery, with ten stamp heads, worked by six mules which are changed every six hours, is capable of stamping from three o'clock in the morning till seven in the evening forty cargas of fourteen arrobas* each.

Fine Grinding: construction of "*Arrastres.*"—*Arrastres*, or as they are sometimes also called, "*Tahonas*," are round, and vary somewhat in size in different places; but those mostly used in the large *Haciendas* of *Guanaxuato* have a diameter of 4½ varas,† and are called "*Arrastres de marca.*" The annexed drawing,‡ fig. 1, is a

FIG. 1.



sectional elevation, and fig. 2, a ground plan: these will enable the reader to comprehend the construction of the mills. The bottoms are formed of hard stones, each stone being about from 28 to 30

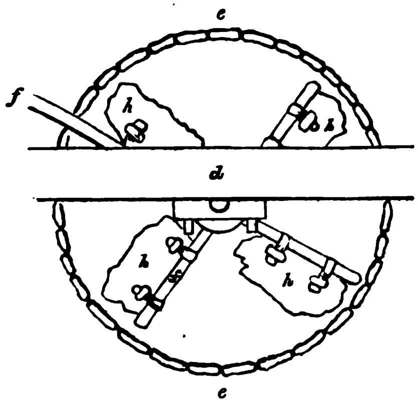
* An arroba is 25lbs.

† A vara is equal to 33 English inches.

‡ For these drawings I am much indebted to Mr. John Phillips, formerly Secretary to the Real del Monte Company.

inches long, and about 4 inches thick; they are placed vertically one against the other, as shown at *a*, the interstices between being filled up with "*Cabecilla*" (the residue remaining after washing a torta) moistened with water. In the centre of the circle there is a massive

FIG. 2.



stone, *b*, which rises somewhat above the floor of the mill. To this is attached, by means of a pivot, an upright shaft *c*, supported by a cross beam *d* at the top. The sides of the arrastres are formed of flag-stones *e*, or in some places planks of hard wood, which rise above the floor about 2 feet. To the upright shaft *c* are attached two cross bars *f f*, to which to harness the mules and secure the "*Voladoras*" or grinding stones *h h*, which in Guanaxuato are of porphyry; their size being a little less than the radius of the arrastre, and being about 16 inches thick, the same height, and about 2 varas long. In each of these stones two holes are bored, into which are fixed wooden pegs *i*, to which the stones *h h* are attached by strings of hide or pieces of chain, *j*, to the cross bar *f*. For an arrastre of the dimensions given above, four grinding stones or voladoras are required, and two mules are necessary to work them.

Porphyry appears to be the stone best suited for the purpose of forming grinding-stones, from the fact of its being coarse-grained, and presenting a rough surface to the last. Basalt, which is very plentiful in the district of Real del Monte, is there used for this purpose; but, although sufficiently hard, it very soon becomes smooth, and passes over the ore without having the same grinding effect as porphyry.

As soon as the bottom of an arrastre has been put in, a new "*Voladora*" is set to work to grind "*Cabecilla*" mixed with water. This ensures the whole of the interstices being filled up, and is continued for one day, when a second stone is attached. At the end of three days a third is added, when the grinding of poor ores may be gone on with, and after four or five days the fourth stone is added and the fine grinding gone on with.

Fine grinding in Arrastres and extraction of Gold.—In districts such as Guanaxuato, where the ores contain gold as well as silver, the

former metal is generally in such small quantities that if extracted as an alloy with the whole bulk of the silver it would scarcely pay the cost of extraction, at least in Mexico, but by adopting the plan of keeping the arrastres charged with mercury during grinding, the gold is concentrated and made to yield very handsome profits. When this method of concentrating the gold was first used in Mexico we are not at present aware, but Humboldt states that he was informed it was in use in some districts in 1804, but that it was not employed in Guanaxuato, where he was, nor did he see it in operation.

The quantity of ore from the stamping mills charged to each arrastre at one time varies according to circumstances; however, in the best regulated works in Guanaxuato, where the grinding is without doubt carried to greater perfection than in any other district in the republic, an arrastre of the dimensions given above is charged with from six to seven quintals.* To this is added a barrel of water —about ten gallons—which is enough to bring the mass to the state of a thick cream. On the quantity of water added depends much the quality of the grinding which will result. Humboldt states that in no part of Europe had he ever seen such fine grinding as in the Great Haciendas de Plata of Guanaxuato. If the arrastre be a new one, or one from which the amalgam has just been removed, there is added from 5 to 10lbs. of silver amalgam: that is, after the arrastre is well "*ascentado*," or in good working order. Some amalgamators prefer having this amalgam very "dry," or containing but little free mercury; whilst others again prefer employing it with more mercury. However, it appears to be certain that the less mercury it contains the better, up to a certain point. The reason given for adding amalgam instead of mercury alone, is, that if mercury only were added it would run immediately into the crevices of the bottom, and thus be of little or no use; whereas the amalgam is spread by the action of the stones over the whole surface of the bottom. This I think is true; but it is also evident, from experiment, that amalgam will take up gold and silver much more readily than pure mercury, and that up to a certain extent the freer the amalgam is from mercury the better will it take up the gold and silver. Might not many of the gold amalgamating machines patented of late years in this country have succeeded much better had amalgam been added in place of so much pure mercury? I mean, amalgam from which only a small quantity of mercury would ooze when pressed between the finger and thumb.

From time to time during the 24 hours (the usual time required to grind the above weight of ore) water is added to the arrastre as follows:—The arrastres are charged about four o'clock every morning, when, as we have already stated, one barrel of water (10 gallons) is added; at nine o'clock another, and sometimes one and a half; at eleven o'clock another barrel and a half; at twelve o'clock one barrel; at three o'clock, three barrels, and at five o'clock four barrels—in all twelve barrels, or about 120 gallons of water. This quantity will vary somewhat with different classes of ores. The grinding should be so perfect that no grittiness be felt between the fingers

* A quintal is equal to 100lbs.

'hen the hand is inserted into the mass. As the operation goes on, he amalgam gradually searches into the crevices of the arrastre. Every second morning, a small portion, called a "*Tentadura*," or samle of the amalgam ("*Pella*") is taken from each arrastre, cleaned rell with water, and its condition examined. From its "dryness" r "moistness," that is to say, from the greater or less quantity of nercury which can be expressed by pressing it with the thumb gainst the inside of the "*jicara*" containing it, is judged how much, r if any, fresh mercury will have to be added to the next grinding; or the almagam is not removed but at the shortest every three nonths, unless the ores be unusually rich in gold, when the arrastres are reed from amalgam. The usual amount of fresh mercury added to ach arrastre during grinding is about half a pound every second day. However, this will vary very much with the ores operated upon; ut as a rule the amalgam should not contain more than about 20 per ent. of gold and silver. At the end of the 24 hours, when the grinding is concluded, the "*lama*" or slime is baled out with wooden bowls ("*Bateas*") about half a vara in diameter, into a barrel, in which it is carried and poured into a place prepared for its reception. In some haciendos it is baled into a small wooden launder which leads to the receptacle; and in other works each arrastre is furnished with a large plug near the bottom, which, when opened, allows the thin lime to run through conduct pipes to the receptacle. When the lime is removed by hand with a bowl, there is laid on the bottom of he arrastre a small plate of lead or iron, so as to prevent the bottom rom being scraped and any of the rich amalgam being removed by he bowl. This operation lasts but a very short time, about half an our, and when concluded a fresh charge of *granza* from the stamps is dded, and the grinding again gone on with as we have described. Two mules, which are changed every six hours, are attached to each rrastre. In this operation there is generally an augmentation of veight to the extent of about 8 or 10 per cent. from the wearing away f the grinding-stones. In most cases the arrastres are arranged in a louble row in a house called a "*Galera*" (gallery). The bottom of an rrastre will last about twelve months, but the "*Voladoras*" or grinding stones do not last more than a month, and in many instances not ven so long.

There appears to be an alloy of gold and silver which will not combine with mercury. My friend, the late Mr. Henry Mackintosh, who had long experience in these matters, stated to me that on two occasions he had found an alloy of gold and silver which he could not get to amalgamate after continued grinding with mercury for six months. Mr. Mackintosh could not remember the composition of his alloy, but he thought it contained about 50 per cent. of silver and 50 per cent. of gold. Sonneschmidt, in speaking of the action of mercury on gold, states—"On various occasions I have seen native gold very finely divided that would not combine with mercury, which I thought was owing to the surface being covered with some foreign matter; at the same time, if this was the case, the film was so small as not to be perceptible."

Removing amalgam and clearing out arrastres.—"*Raspando*" (scraping) is the name given to the operation of removing the amalgam

of silver and gold from the arrastres. It is done as follows. At the end of about every quarter, or sometimes only every half-year, according to the quality of the ores being ground, after the arrastres have been discharged, the workmen proceed to scrape all the stuff from the interstices between the stones forming the bottom, which they do with hooked pieces of iron. The stuff removed is a mixture of coarse pieces of stones—are very finely ground—and amalgam of silver and gold. If the arrastre be entirely worn out, the whole bottom is removed and everything well scraped and cleaned, when a new bottom is again put in.

That which has been collected from the bottom is next well washed by hand, in large wooden bowls, in a tank filled with water. A certain portion of the stuff to be washed being placed in the bowl, there is then added a small portion of mercury for the purpose of collecting the finer particles of amalgam, and prevent them, as much as possible, from being washed away by the water. The bowl is now moved about in the water in such a way as will best favour the collection of the heavy amalgam and the removal of the lighter or earthy particles which are collected in the bottom of the tank, and is again washed on an inclined plane called a "*Planilla*," so as to obtain as much as possible of the precious amalgam. Still, some of this is in such a fine state of division, from the long-continued action of the grinding stones, that much of it is lost even by the second washing, and no method has yet been invented by which the last traces of this finely divided portion can be saved. The amalgam, after having been collected and cleaned, is freed from as much mercury as possible by being pressed in a leather bag; the dry amalgam is next burned (as we shall describe further on) to expel the remaining portion of the mercury, when an alloy of gold and silver remains. This is next removed to the Government melting and assay office to be melted into bars and assayed, before being sent to the mint to be "*parted*." This alloy is termed "*Plata mixta*" (mixed silver.)

Loss of Gold.—By this method of grinding there is still a large loss of gold. From 25 to 33 per cent. on the assay may be taken as an average, and it is said by some to be as high as 40 per cent. The whole of this loss has never been satisfactorily accounted for; but there is always a certain portion washed away in the form of very fine amalgam in washing the stuff from the bottom of the arrastres. The silver obtained from the treatment in the patio always contains a certain amount of gold, and the "*Polvillos*," which are the metallic portions (principally sulphides of iron rich in silver) remaining from the washing of a torta, always contain gold. These "*Polvillos*" are treated a second time to retain whatever gold and silver they may hold; but they will not yield them by the common method, without a preliminary operation. I think it quite probable that the gold may exist in these *Polvillos* as a sub-sulphide.

Loss of Mercury in the Arrastres.—In many of the works which treat on this subject it is stated that it is only the native metals that are taken up or extracted in the arrastres, and the "*Asogerros*" (amalgamators) in general think that to amalgamate any quantity of the precious metals an equivalent weight of mercury *must* be sacrificed. It is, however, very evident that in the arrastres the mercury

ctually acts on the sulphide of silver, forming metallic silver and ulphide of mercury. The following gives the details of an actual esult obtained in a reduction works at Guanaxuato. The amalgam dded to the arrastre was 70 lbs., and was composed of 14 lbs. of ilver and 56 lbs. of mercury :—

Additional mercury added during the whole time of grinding (exclusive of above)	330 lbs.
Mercury in amalgam added	56 „
"Plata mixta" (gold and silver) obtained, including the above 14 lbs.	84 „
Amalgam which *ought to have* been produced ...	470 lbs.

ut there were only obtained 400lbs., which was composed of 84 lbs. f gold and silver (plata mixta) and 316lbs. of mercury; which, educted from 386, the total number of pounds added, leaves a loss of 70lbs. Now the alloy contained 18lbs. of gold, which being in the metallic state in the ore would combine with the mercury without loss of the latter. Consequently, if we subtract this 18lbs. of gold from 84lbs. (the total alloy) there will remain 66lbs of silver. Thus we have a loss of as near as can be one pound of mercury for every ound of *silver* taken up (nearly equivalent proportions), the difference eing easily accounted for by mechanical loss in washing, burning, &c. gain, the ores worked in Guanaxuato contain but little or no native ilver, the gold only being in that form; so that it can only be the low reduction of the sulphide of silver by the mercury, and the conversion of the latter into sulphide, that causes the loss. If the ores round contain much native silver, then the loss of mercury will be ess in proportion. Or, if copper amalgam in place of that of silver e added to the arrastres at the commencement of the grinding, the opper will in a short time disappear, and the loss of mercury will be omewhat diminished.

The reduction of sulphide of silver by mercury is a very curious act, and one which I believe has been pointed out before. Still the ollowing statements may be interesting. I took a small piece of ure red sulphide of silver and ground it *dry* in a clean porcelain mortar for about ten minutes with a small portion of mercury. At he end of this time the mercury contained a considerable quantity of ilver, which could only have come from the reduction of the sulphide. In conducting this experiment, it is curious to note that after having round the two substances together for a few seconds, the whole of he sulphide of silver *apparently* disappeared, and the mercury had all he appearance of being highly charged with silver (of amalgam) and pread itself in the form of a paste round the interior of the mortar; ut on adding water to wash out what we thought was a pure malgam, we were disappointed at finding the mercury again assuming the globular form, having only taken up a small portion of the ilver, whilst the remaining undecomposed sulphide of silver mixed with the water. This circumstance, I think, can only be explained by the mercury actually dissolving the sulphide of silver, which pparently can only take place in the dry state.

The following table gives a list, approximately accurate, of the Reduction Works in Guanaxuato, with the number of arrastres or grindin mills in each in 1859.

Name of Reduction Works.	Number of Mills.	Name of Reduction Works.	Number of Mills.
Casas Blancas	50	Brought forward	698
Santa Ana	20	San Luisito	18
San Juan	36	Patrociño	20
Purisima	36	Puerta Grande	26
Trinidad	24	San Jaronimo	50
Barrera	68	San Francisco	30
Barrera en Medio	26	Pastita	50
Dolares Barrera	36	San Agustin	26
San Antonio	24	Noria Alta	22
Cipreses	20	San Nicolas	10
San Pedro	24	Cruz Blanca	14
Rocha	80	De los Pinedas	6
Pardo	30	Puente de Palo	18
San Francisco	16	Luna	30
Flores	30	Duran	20
Dolares	30	San Matias	22
Salgado	56	San Javier	34
Escalera	54	Various small Works	30
San Joaquin	18		
Bustos	20	Total Number of Mills	1,124
	698		

Abstracts and Reviews.

HISTORICAL NOTICES ON COPPER SMELTING IN GREAT BRITAIN.

(From Dr. Percy's "Metallurgy.")

In the time of Elizabeth there was a rich copper-mine at Keswick, in Cumberland, of which that Queen deprived the Earl of Northumberland, on the ground that it was a mine-royal.* It is reported that not less than 4,000 men were employed at this mine; but this is probably a great exaggeration. The ore appears to have been a sulphide; for Webster, the author of the "Metallographia," describes it as an ore "that must be often melted in the fire ere it be brought into the form of good copper." According to Camden, much good copper continued during a long time to be made at Keswick and Newland; but Webster, in 1671, wrote that "now the work is quite left and decayed; yet I am informed that some do now melt forth as much very good copper as serveth them to make half-pennies and farthings."†

* Some Account of Mines, and the *Advantages* of them to the Kingdom. By Thomas Heton, M.A., Vicar of *Layston, in Hertfordshire*, &c. London, 1707, p. 15.

† "Metallographia," etc. By John Webster, etc. London, 1671, p. 244. I have cited Camden on the authority of Webster.

More ancient records of copper-mines exist: thus Edward III., in the fifteenth year of his reign, granted the right of working "the copper-mines of Skildane in Northumberland, and the copper-mine of Alston-Moor in Cumberland, and the copper-mine near Richmond in Yorkshire, during a term of fifteen years, and on payment of a royalty to himself of one-eighth, and one-ninth to the lord of the soil," to a company of adventurers, amongst whom his brother Richard, Duke of Gloucester, and Henry, Earl of Northumberland, are mentioned.* That the copper-ore which was raised in these earlier times was smelted at or near the mines, I think there is reason to suppose, notwithstanding the absence of any positive historical record of the fact. The Hindoos have smelted copper from time immemorial; and to this day conduct the operation in small blast furnaces about three feet high, with charcoal and cow-dung as the fuel. The ores which they employ are not those of the easily reducible class, such as carbonates, but sulphuretted ores, like copper-pyrites. But, if these rude tribes of mankind are able to smelt copper-ores with success, it is not difficult to believe that our ancestors, at least those of the fourteenth century, possessed an equal degree of metallurgical skill. Moreover, it appears certain that copper-ore was raised in this country many hundred years ago, and it must either have been smelted at home or exported; but I am not aware whether there is any historical evidence of the fact of such exportation; if not, we have an additional though negative argument in favour of the supposition which I have above ventured to express, concerning the early history of copper-smelting in England. On the other hand it should be stated, that our ancestors imported copper from Hungary † and Sweden, and allowed calamine to be exported as ballast.‡

Copper-works were in operation in Yorkshire during the last century. Mr. Keates has communicated to me the following particulars on this point:—"Copper-smelting, I believe, was carried on in Yorkshire to a limited extent; but all that I know of it was told me by old Samuel Burgoyne in 1822, who at that time was eighty-four years of age, and was consequently born in 1738. His father worked at the copper works at Middleton Tyas, in Yorkshire. He said, 'The ore was green and red, and smelted by blast. The work stopped when I was about twelve years, and we came to live at Ecton.'" Mr. Keates has furnished me with a copy of a memorandum which confirms the preceding statement:—"April 17th, 1752.—Assayed the sample of Middleton Tyas round ore brought me by Mr. Rotton's son. Quantity T13. c4. 2qrs. 13lbs. . . . . . 20 dwts. produce 9 dwts. of fine." This shows that the ore yielded 45 per cent. of fine copper. Jars states that in 1765 copper-smelting in this locality was effected in reverberatory furnaces, and that various kinds of ore were raised from the neighbouring mines, amongst which he mentions green carbonate of copper, vitreous copper, and rarely yellow ore, or copper pyrites.§

In Staffordshire copper-smelting was carried on at the village of Ellaston, near Ashbourne. The ore was obtained from the well-known Ecton mine in the vicinity. Specimens of this ore, which I have seen, consist of copper-pyrites in association with calc-spar. Plot, writing in 1686, informs us that when he visited Ecton, the mine had ceased to be worked, and that at the mills at Ellaston, where they smelted three kinds of ore, "all was out of order," the famous *wooden-bellows* that had no *leather* about them "having been carried away to Snelston, in Derbyshire," whither he went to see them. From this it is clear that the smelting was conducted in

* Heton, op. cit., p. 9.
† See Specification of Patent to George Danby, A.D. 1636, Jan. 21.
‡ Heton, op. cit., pp. 153, 154.
§ Voyages Metallurgiques, 3, p. 72.

blast furnaces.* According to Plot, the stoppage of the mine and smelting works was on account of "*Copper* coming cheaper from *Sweden* than they could make it here."

The working of the Ecton mine was resumed; and Mr. Keates informs me that about 1750 the ores raised from this mine were smelted at Whiston, and some of the copper was carried to a forge at Bosley, on the river Dane, near Macclesfield, where it was hammered out into pans, &c. Other Staffordshire copper-ores were smelted at Cheadle about 1780. Mr. Keates has also communicated to me the fact that copper-ore was raised at the Ribden Mine, distant a few miles from Alton Towers, and smelted at a place in the vicinity called "Blazing Star," on account of the light emitted at night; so that a blast furnace was probably employed. The ore consisted chiefly of carbonate and oxide of copper. Webster states, on the authority of one Dr. Merrett, that a copper mine existed at Wenlock, in Staffordshire.†

The following historical notice of copper-smelting in Lancashire has been kindly supplied by Mr. Keates:—

"The first introduction of copper-smelting into Lancashire was by the ancestor of the present Colonel Patten; the works were at Bank Quay, on the banks of the Mersey, near Warrington. The building of these works commenced in 1717 or 1718. The ores were principally Cornish and Irish, with small importations from the West Indies and the British Colonies in North America; some also were got from Alderly Edge, Coniston, &c. These works were dismantled, I believe, about 1780. The next works in Lancashire were built very near Liverpool: the present Mersey Iron and Steel Works stand on their site. They were carried on by Roe and Co., who had a brass manufactory at Macclesfield. Cornish and Irish ores were smelted at these copper-works, which were discontinued about the year 1800. Next in succession were the works at St. Helen's and at Stanley, a few miles distant. These works were of considerable magnitude, and were established by the father of the late Lord Dinorben and his partners for smelting the ores raised at the Parys and Mona Mines in Anglesea. I have not the exact dates, but I believe they were begun about 1780, and discontinued between 1812 and 1815. Copper-smelting then ceased entirely in Lancashire, but was resumed in 1830, when the writer built works at Ravenhead, near the site of the old St. Helen's works, primarily with the object of smelting the ore raised at the mines of General Bolivar in Columbia, the legislature having granted permission to import and smelt foreign ores in bond, on condition that the produce should be exported in the state of cake or ingot copper. The works at Sutton, near St. Helen's, were also built by the writer shortly after those at Ravenhead; and these have been followed by others, so that at present the quantity of fine copper smelted from ore in Lancashire is probably not less than 6,000 tons per annum. The principal ores smelted are from the west coast of South America, Canada, Cornwall, Ireland and Wales, together with the sulphides of low produce imported by the chemical manufacturers from Spain, Portugal, &c., who first extract the sulphur from them and then turn them over to the copper-smelters."

In the last century copper-smelting was carried on in Gloucestershire, at Bristol, and other neighbouring localities; but I have not been able to ascertain when it was first established in this country, or when it was discontinued.

Jars published, in 1781, a description of the smelting of copper in the vicinity of Bristol. There were two works to which the greater part of the ores raised in Cornwall were conveyed by sea. Reverberatory furnaces were used, of which there were not less than fifty in one of these works.

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* The Natural History of Staffordshire. By Robert Plot, LL.D.: Oxford, 1686.

† Op. cit., p. 244.

The regulus, preparatory to calcination, was broken and ground under edge-stones by horses.*

Aikin, writing in 1797, states that at Amlwch port, in North Wales, the poorest ores of the Parys Mine, which yielded only from 1½ to 2 per cent. of copper, were partially smelted, so as to produce a regulus containing 50 per cent. of copper, which, together with the rich ores, was exported to Swansea. There were two companies, each of which had a smelting-house, in which were thirty-one reverberatory furnaces.†

Copper-works were established by the Union Company, at Risca, near Newport, Monmouthshire, in 1807, and continued in work till 1817, when the copper trade being much depressed, the smelters determined to reduce the number of works; and they accordingly drew lots to decide which works should be given up. The lot fell upon the Risca works, which were consequently abandoned, and the buildings have since been used as chemical works.‡

We now arrive at the history of copper-smelting in South Wales. In Carew's "Survey of Cornwall," of which the first edition was published in 1602, is the following passage:—"Touching metals: Copper is found in sundry places, but with what gain to the searchers, I have not been curious to enquire, nor they hasty to reveal; for at one mine (of which I took a view) the ore was shipped to be refined in Wales, either to save cost in fuel, or to conceal the profit.§ From the evidence which I shall adduce, and for which I am indebted to Mr. G. F. Francis, it may be certainly concluded that the first copper-smelting works at Swansea were not erected until after 1720; and that anterior to this date copper-smelting works existed at Neath.

In George the Third's collection of topographical engravings, in the British Museum, I have found a curious old Indian ink drawing of copper-works at Llangefelach, the parish adjoining Swansea; and though I do not know when they were erected, yet it will be shown in the sequel that they were in operation in 1745.

From the evidence which has now been advanced we may, I think, conclude with certainty that copper-smelting had been extensively carried on at or near Neath for a considerable period before it was established at Swansea; but I have not yet succeeded in obtaining more precise information on this subject. Carew, however, it will be remembered, states that copper "was refined in Wales;" and as this statement was published in 1602, there can be no doubt that copper-smelting was in operation in the Principality before that date. The term *refined*, in the passage quoted from the "Survey of Cornwall," is evidently used as synonymous with our present word *smelted*. Hence, unless it can be shown that when Carew wrote, copper-smelting was conducted in other parts of Wales, we may reasonably infer that the art had attained a considerable degree of development at or near Neath at least 120 years prior to its introduction into Swansea. It must be left to future antiquarian researches to elicit more precise evidence on this subject than we at present possess.

In Cornwall during the last century several unsuccessful attempts were made to smelt copper, of which a record has been preserved by Tonkin; and as the history of these failures may convey an important lesson to

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* Voyages Metallurgiques, 3, p. 222.

† Journal of a Tour through North Wales, &c., by Arthur Aikin; London, 1797, p. 133, et seq.

‡ I am indebted to Mr. Octavius Morgan for this information concerning the Risca works.

§ Carew's "Survey of Cornwall;" to which are added Notes illustrative of its History and Antiquities; by the late Thomas Tonkin, Esq., and now first published from the original manuscripts by Francis Lord De Dunstanville; London, 1811, p. 21. See also the note p. xii. as to the date of the first edition.

persons engaged in mining adventures, I insert this record without abridgment: it is contained in Lord de Dunstanville's edition of Carew's "Survey of Cornwall," and was evidently prepared in 1739 with a view to publication:—*

"This variety of ores and great increase in the mines has occasioned the setting up of six several companies for the buying of the ore, but who take care to keep us as much in the dark as they can, by shipping off all the ore to be smelted in their houses near Bristol, in Wales, &c., under a pretence of saving cost in fuel, but in reality to conceal the profit, as Mr. Carew very justly observes; so that we must be entirely at their mercy, as, not understanding the true value of the commodity ourselves, or, if we did, they know that it would require a greater purse than any one private gentleman can be supposed to be enabled to lay out. It was, however, attempted about thirty years since by the late John Pollard, Esq., and Mr. Thomas Worth, jun., at St. Ives; and before them by Mr. Scobell, at Pol Ruddan, in St. Anstell, with whom the late Sir Talbot Clarke and the old Mr. Vincent joined, and when the first piece of copper that ever was so (*sic*) in this country was smelted, refined, and brought to perfection. But both these attempts failed of success, more through ill-management, roguery of the workmen, and the ill situation of the said smelting houses, than any defect in the ore, or charge of the fuel. Since this, one Gideon Collier, of St. Prian-in-the-Sands, erected a house for the like purpose, at Penpol, in the parish of Phillack: but being soon taken off by a fever, in the best of his time, when he had made a fair progress in it, the same was carried on by the late Sir William Pendarves and Robert Corker, Esq., who have (particularly the last, with whom I have often discoursed about it,) assured me that they could smelt their ore as cheap there, all hazards considered, as the companies could pretend to do at their houses in Wales, &c., and did so accordingly for some years. But they being both since dead, and their affairs falling into such hands as had other interest to mind, this project too sunk with them. A small beginning was also made to the same purpose at Lenobrey in St. Agnes', where they smelted some pieces of copper with good success; but were forced to give it over for want of a sufficient stock to go on with it. From all which essays, and some observations I have made of my own and gathered from some workmen abroad, but chiefly from the late Mr. John Coster, who owned to me that most of our ores might be smelted rough here as cheap as abroad, but not brought to the true fineness (for what reasons you may easily guess), and therefore must be shipped off to be refined, I am fully convinced that the ore may be smelted here, and refined too (that pretence being a mere cant to conceal the real value), all things considered, at as small an expense as it can be done in Wales, &c. And if we allow for the great salaries the said companies are obliged to give to their agents here and elsewhere, the great charges they are at in working the mines (which they covet at any rate to get into their own hands), the hazard of the ore on shipboard, especially in time of war, and many other incidents, which would be saved if the ore was smelted here, I believe it would amount to a demonstration that it would even be done much cheaper in some convenient places in this country than in Wales, &c. What advantage from this would accrue to our country in general is too obvious to need any more words; and this the copper companies know but too well, and therefore keep us as much" * * * * * *

[Left unfinished by the Author.]

In 1754 copper works were erected at Entral, in the parish of Camborne, and afterwards removed to Hayle, where coal could be procured at a less cost. According to Price, the [copper] companies left no method unsought

* P. 22.

raduce the credit and stab the vitals of this undertaking. Threats and onstrances were equally used to oblige or cajole the owners of the es to abandon or suppress the new company at Hayle. The opponents his association, using every expedient to mortify the spirit of this ious undertaking, alternately raised the price of copper-ores, and red the value of fine copper, to the great loss of the contending ies, which will ever be the case where monopolies are disturbed the almighty power of opulence can prevail. But happening to have of fortune and capacity at their head, they were founded in lence, and withstood the shocks of power and artifice."* The author informs us that copper works were subsequently erected orth Downs, in Redruth; but the locality proving unsuitable, they were oved to Tregrew, on a branch of Falmouth harbour, where they were ied on with advantage.

rom the language of these writers, it is evident that the Cornish mine nturers considered themselves the victims of a conspiracy on the part e Welsh copper-smelters. But it is difficult to understand why copper-lting should have ceased in Cornwall if it had really been so profitable rice declares. In one instance, at least, failure was not due either to ciency of capital or incapacity in the management. As the adventurers themselves so much aggrieved by the smelters, they might have entered a combination to keep up the price of copper-ore. Of all facts, e are more stubborn than those of political economy; and the h of the matter appears to be, that copper-smelting can be conducted greater profit in Wales than in Cornwall; and, therefore, it has be-e extinct in the latter county. When a man has an article for sale he ht to know how much it has cost to produce it, and to fix such a price n it as he considers remunerative. So the miner should determine the e of the ore which he raises, irrespective of the profit which it may sequently yield to the smelter; and he has no right to impute injustice he smelter who declines to inform him of the gains arising from the allurgical treatment of the ore, and to allow him to participate in those s, which often entirely depend upon the exercise of individual skill the possession of sound commercial knowledge. Whatever the profits opper-smelting may have been in former times, it is certain that the lters of the present day do not, in general, realize more than they are y entitled to expect.

he last county to be mentioned in which copper-smelting has been con-ted is Middlesex. About fifteen years ago works were erected on Bow mon for the purpose of smelting copper by a process devised and nted by Mr. James Napier, which will be described in the sequel. locality was not suitable, and, as might have been anticipated, the ks were speedily abandoned. The chief promoter of the undertaking , I believe, the late Mr. Benjamin Smith, the silversmith, of Duke et, Lincoln's Inn Fields.

owards the end of the last century, probably between 1780 and 1790, per-smelting was carried on at Ballymurtagh, Wicklow, Ireland. ough the kindness of Mr. Moyle, of Chatham Dockyard, I have re-ed the following information on this subject from Mr. Edward Barnes, present resident director of the Ballymurtagh Mines, now worked by Hibernian Mining Company. Mr. Barnes writes that, "when we first menced the mine, none of the persons employed at the works were g, or at least remaining in the neighbourhood, and no records are to ound in the office of the Hibernian Mining Company on the subject. ink I have heard it stated that the smelting works were erected by glish parties, the Mining Company selling them the ore as raised. At

* "Mineralogia Cornubiensis." London, 1778, p. 279.

the period referred to, I rather think a considerable export duty was levied upon copper ores, which, added to the low produce of the ore of Ballymurtagh and its high per centage of sulphur, were the chief causes of erecting smelting works near the mine. An attempt was also made to save the sulphur by combining the ores in rude kilns in the open air, the sulphur fumes being received into long horizontal flues. This process was very slow and unsatisfactory, and there is reason to believe the Company were losers by it. Judging from the cleanness of the slag at Ballymurtagh and at Arklow, it would appear that the process was well carried out and no copper left in it; but no doubt there must have been great disadvantage in operating upon one stubborn class of ore. The Company had a patent for coining their own copper tokens, as had also the Associated Irish Mining Company at Cronebane, who tried smelting on a smaller scale. This, I believe, was a general medium of payment with similar companies at the period."*

It would be difficult to select in this country a more eligible site for copper-smelting works than Swansea; and this for two reasons. The first is, that it is a good seaport, which is only at a short distance from Cornwall and Devonshire, the two counties in which the greatest amount of copper-ore is raised, and it is also easily accessible to vessels conveying ore, or products containing copper, from South America, Australia, and other parts of the world. The second is, that extensive collieries exist in the immediate vicinity, from which an abundant supply of coal can be obtained at a low price. Many of the smelters are themselves engaged in the working of collieries, and are thereby enabled to dispose of their coal to the greatest advantage, the large being sold at a good profit, either for home consumption or exportation, and the small, which is often very *dirty* from an admixture with shale, being reserved for the copper-furnaces. It is advantageous, both for the mine-adventurers and the smelters, that the process of smelting should be carried on in a locality where copper-ores of various kinds may be procured, for it is well known that frequently copper can be extracted at a less cost by smelting several ores in admixture than by smelting any one ore by itself. An illustration will make this point plain. Suppose we have two kinds of very poor ore, one consisting almost wholly of oxide of iron and the other almost wholly of quartz. It might not be profitable to smelt either separately; for, in the case of that of oxide of iron, it would be requisite to add quartz as a flux, and in the case of that of quartz, it would be requisite to add oxide of iron as a flux. But it might be profitable to smelt the two ores together, as one would then serve as a flux to the other, and each would yield copper. This is not an imaginary case. The smelter, by having at command a variety of ores, may render an ore profitable which otherwise would have no value. Adventurers in copper mines would do well to consider this matter, and to be cautious how they embark capital in the erection of smelting works which can only derive a supply of ore from some one particular mine. However, I do not mean to assert that particular copper ores cannot be smelted with profit. The advantages which Swansea possesses as a site for copper-smelting are shared in a greater or less degree by other localities in the vicinity, such as Neath and Llanelly. The copper works near the Lancashire coast may be well situated for the importation of ores, for the exportation of copper from Liverpool, and for supplying the great local demand in Lancashire and the West Riding of Yorkshire; but they cannot obtain coal at the same price as Swansea and its neighbours. The Swansea smelters enjoy the privilege of pouring dense volumes of thick sulphureous and arsenical smoke from comparatively *low* chimneys into the atmosphere, and destroying vegetation

* MS. Ovoca Lodge, Ovoca, May 9th, 1861.

npunity for a considerable distance round. This privilege has now lapse of time become an established right, which would not readily ceded in many other parts of the kingdom. The inhabitants of es generally seem to be habituated to the inhalation of the smoke, submit to the evil, if evil it be regarded, with unmurmuring ation.

ANNALES DES MINES ON THE PRESENT POSITION OF THE METALLURGY OF IRON IN ENGLAND.

s des Mines, ou Recueil de Mémoires sur l'Exploitation des Mines, ur les Sciences et les Arts qui s'y rapportent. Rédigées par les ineurs des Mines, et publiées sous l'Autorisation du Ministre des raux Publics. Cinquième Serie. Tome XX. 1861. Paris: Dunod, i des Augustins.

(Second Notice.)

r last number we gave a brief abstract of certain portions of the art of the memoir in the *Annales des Mines* on "The present State of letallurgy of Iron in England," by MM. Gruner and Lan. The l part is continued in Vol. XX., occupying the greater part of the *livraison* for 1861: from it we proceed to make the following cts.

CESSIVE MODIFICATIONS IN THE WORK OF ENGLISH FURNACES SINCE 1835. improvements which have been effected in English iron works in this t during the last thirty-five years may be classed under the following :—

Economy of Combustible.—The economy in this respect has been principally brought about by the adoption of the hot blast, and the substitution tain districts of raw coal for coke. The simple enlargement of the of the furnace, also, has effected a considerable saving in the amount mbustible consumed; although, with regard to this modification, its tages have been evidently exaggerated by Truran, who attributes the ny of fuel realised in iron-making in England during the last 30 years t exclusively to this enlargement of the throat!

t of the improvements date from a period between 1830 and 1835, ave been already described in the second edition of *Voyages Métallur-*. The consumption has also been reduced, in certain works, by ng the character of the produce. Instead of *grey* forge, they seek only duce *mottled* feebly carbonised. This is especially the case in Wales, ularly where a large addition of forge cinders or very siliceous red tites is used. It may be questioned, however, if such an economy is ught too dearly by the depreciation of the products, for such pigs can roduce very mediocre iron or rails, and that with a greater waste n the case of ordinary pig iron. The reduction of the ores in this s, besides, always incomplete, and their yield consequently less.

ally, another means of economising the combustibles, which has been yed for some time in France and Germany, is the utilisation of the as products of blast-furnaces. In this respect the English iron-masters been long and are still behind their continental brethren, as has been d out by Mr. S. H. Blackwell, in his "Lecture on the Iron-making rces of the United Kingdom." The first attempts in this respect were in England in 1845, at Ystalifera and Ebbwvale. At present, the es of Cleveland, and half of those in Wales, utilise the gases for the g of the air and the boilers, while it is still the exception in Stafford- and Scotland. Many English iron-masters, and Mr. Truran at their maintain that it is impossible to utilise the gases of a blast furnace

without deranging its operation. This is, indeed, true in the case of large throats, and when the draught brings the gases along the circumference of the furnace, or along the surface of the materials; but all inconvenience disappears when they are taken through the centre by means of apparatus arranged like those of M. Coingt de Montluçon. From this yet incomplete utilisation of the gases, it results that on an average there is more coal consumed per ton of pig-iron in England than in France. But the consumption has, nevertheless, been considerably reduced within the last 30 years in the English iron-works.

In 1830, the consumption in Wales per ton of forge pig averaged 4 tons of coal; at present, in the works where the gases are utilised, from 2 tons to 2½ tons. In Staffordshire, for grey forge pigs, about 1830, the consumption was from 6 tons to 6½ tons; at present, with calcined ores of about 40 per cent., it averages about 4 tons. In Scotland, before the employment of raw coal and hot air (1828) the consumption was from 7½ to 8 tons of coal, calcining and engine included; at present, with calcined ores of from 55 to 60 per cent., it is only from 2 tons 8 cwt. to 2 tons 12 cwt. Lastly, in Cleveland, where the gases are well utilised, from 2 tons 16 cwt. to 3 tons is burned in heated calcined ores. In France, on the other hand, in a considerable number of works, the consumption does not exceed from 2 tons to 2 tons 4 cwt., when the coals are highly carburetted, and the ores of the mean produce of those of Wales, Cleveland and Staffordshire (40 per cent.), as at Loire and Creusot. But also when the ores are poor, as at Aubin and Decazeville, and the coal weakly carburetted, the consumption rises equally to 4 or 5 tons.

2. *Increase of Production.*—The mean production of blast-furnaces has been more than doubled within 30 years, which has necessarily considerably reduced the general expenses.

Twenty-five or thirty years ago, the blast-furnaces of Wales produced, on an average per twenty-four hours, from 8 to 9 tons of forge-pig, and those of Staffordshire 7 tons. At present, taking with Mr. Hunt the mean of all the works, we find the return 20 tons in the first district, and from 12 to 13 in the second; but many blast-furnaces reach from 15 to 20 tons in Staffordshire, and from 30 to 40 tons in Wales. We find, similarly, 19 tons as an average in Cleveland, and 20 tons in Scotland, instead of 7 tons thirty years ago.

This increase is entirely due to the enlargement of the body of the furnaces, for the production per cubic content is not greater now than formerly. The rate of the descent of the charge, and the time required for the reduction and fusion of the ores, have remained sensibly the same. The augmentation of the volume has been besides rather effected in width than in height; the diameters of the belly and the throat have been especially modified, and rarely the height of the body.

Nevertheless, in order to push the production of blast-furnaces, it does not suffice merely to increase the volume--it is also necessary to augment proportionally the volume of air. Therefore, the volume or number of the blowing cylinders has been nearly doubled, and, in certain cases, the pressure of the air increased at the same time. In certain works, those of Cleveland and Staffordshire in particular, in order to double the volume of air, the section of the existing tuyeres has been doubled; elsewhere, they have increased the number. Thus in Wales they have advanced from 2 or 3 to 5 or 7, and in Scotland even to 8 or 10.

3. *Improvement in Mechanical Appliances.*—The principal modification introduced into the mechanical appliances employed in blast-furnaces is the transformation of the blowing-engines. Formerly, the old Watt type of engine—low pressure and condensing—was only used, the diameter of the cylinder of the engine being exactly half of that of the blowing cylinder. Now, high-pressure engines are usually used: and to the adoption of these

, Truran attributes the enormous saving of a half or even two-thirds ibic foot of air, in the coal consumed. The fact is, however, that simultaneous modifications have equally contributed to make up this saving. The high-pressure engines have one great advantage in being more readily, at any given time, to augment rapidly the motion, consequently the pressure or volume of the air.

apparatus for raising the materials, and the consequent cost of this tion, have been generally simplified. Where blast-furnaces are not at the foot of a hill-side (where the materials can be wheeled direct he furnace) instead of the old inclined planes, or vertical chain lifts, -balances are generally used, and in the most modern works, like those eveland, the pneumatic lift, which is a kind of gasometer of small ter, but a little higher than the furnace itself. This is evidently, of ting appliances, the most simple, and the least subject to derangement. iong appliances which aid the reduction of the necessary expenses we mention the iron waggons into which the slags from the furnaces flow dy, and which are subsequently removed by rail.

t air apparatuses have been but little modified in England during the 15 years. In this respect, and in that of the utilisation of the gases, iron-masters of the continent have nothing to learn from those of and.

Reduction of the Cinder.—A last modification, which helps to reduce est of the production of pig-iron, is the employment of forge cinders ice of ore. The cinders are a rich ore of small value, but their re- on is difficult and always incomplete; besides, they not only whiten the ing crude-iron, but render it besides very siliceous, and charged with phorus. This means, therefore, cannot be had recourse to, except in ase of the making of pig-iron of a quite inferior quality. This is the in the Welsh works, where in general they re-smelt, without exception, whole of the cinders derived from the refining; and it is the same in ase of certain establishments in Staffordshire, where inferior iron is at a low price. But in the greater part of the works of this district, n all those of Cleveland and Scotland, the employment of cinders is xception, and when it is used it is always in very small proportion. d, the use of cinders gives an economy more apparent than real. As as the proportion of cinder is pretty great, the half of the oxide of iron e cinders almost always passes directly into the slags.

RMS AND DIMENSIONS OF BLAST FURNACES.—Under this head a vast unt of valuable information is given as to the form, relative production, character of produce of the various types of blast furnaces in use in t Britain. This portion of the memoir, which is illustrated by Plate accompanying this number of the Magazine, we find too lengthy to de this month, particularly as it comprises several tables. We must equently postpone it until our next number, as the matter will not separation.

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ie Chemical Composition and Origin of Granite and other Rocks; an ldress delivered before the Geological Society of Dublin, by the Rev. muel Haughton, F.R.S., President, on 12th February, 1862.

IOUGH the purpose of our Magazine is primarily practical, and conse- tly implies an exclusion of lengthened notices on purely scientific rs, we think it will be unnecessary to apologise to our readers for g before them the following abstract of Mr. Haughton's address on a ct which has recently created so much interest among geologists; and

which has, more than any other branch of that science, such important practical bearings, particularly as elucidating the mode of origin of metalliferous deposits.

"In former addresses to this Society, I have invited your attention to various astronomical theories of the original formation of our planet, of the internal heat of the globe at present, and of the causes of change of climate. On the present occasion I purpose to follow up my former addresses, by giving you my views as to the mineralogical and chemical composition of the rock masses of which the earth is composed; and in so doing I shall carefully distinguish my own speculations from the numerous and well-ascertained facts observed by myself and others, more especially the chemical geologists of Germany and France, in which countries, the physical and chemical laws at work among our rocks, and the physical history of our globe itself, receive that attention which their importance demands, and which they, in vain, solicit from the eyes and pens of English geologists.

"I adopt as the fundamental hypothesis of the physical history of our globe the nebular theory of Laplace, and the physico-chemical hypothesis of Durocher, which supposes the two outer layers of our globe (on cooling from the molten conditions required by the hypothesis of Laplace) to have acquired their relative positions of outer and inner layer, not only by virtue of their relative specific gravities, but also in accordance with their definite chemical compositions; so that the specific gravity of each layer, which by the action of mechanical laws fixes its position in the earth, is itself the result of its chemical and mineralogical composition.

"The hypothesis of Laplace is so well known, that I do not feel it necessary to describe it; but that of Durocher is so little known or understood, that I gladly avail myself of the present opportunity to offer it to you in his own words:—

"'An immense number of consequences may be logically derived from the following proposition, the proof of which I shall furnish presently, viz.:—*That all igneous rocks, modern and ancient, were produced by two Magmas, which coexist below the solid crust of the globe, and occupy there each a definite position.*

"'The Upper Magma, which is rich in silica, and poor in earthy bases and oxides of iron, possesses the least specific gravity; and in this respect there are differences among the rocks produced by the two Magmas, from one and a half to twice as great as between oil and water. The separation is still greater if, in place of considering the rocks in their natural condition, we compare the vitrified products obtained by their fusion: further still, if we refer them to their liquid condition, there ought to be, according to Bischoff's experiments, between the rocks arising from the two Magmas, differences twice greater than those observed in their crystalline state, and, therefore, from three to four times greater than those between oil and water: from these facts may be deduced the necessary and permanent separation of the two Magmas.

"'These two Magmas have undergone but slight changes of composition from the most remote geological epochs; and, moreover, they differ essentially from each other by means of well-defined characters. The one may, from its excess of silica, be called the Acid Magma; while the other is comparable to a basic salt; for its silica is not in sufficient quantity to saturate its metallic oxides. The difference of silica in the two Magmas is in the proportion of 7 : 5. They contain nearly the same quantity of Alumina; but the Siliceous Magma contains from one and a half to twice as much alkalies, and more Potash than Soda, while the reverse occurs in the Basic Magma. The first is specially characterized by its poverty in earthy bases, and the iron oxides; of these it contains from six to eight times less than the other.

"'The following Table gives the composition of these Magmas, and the specific gravities of the rocks derived from them.

	Proportions of Elements.			
	Mean Proportions in the two Magmas.		General Limits of Proportions in the Igneous Rocks.	
	1. Siliceous.	2. Basic.	1. Siliceous.	2. Basic.
Silicia	71 ·0	51 ·5	62 to 78	45 to 58
Alumina	16 ·0	16 ·0	11 to 20	11 to 20
Potash	4 ·5	1 ·0	3 to 6	½ to 3
Soda	2 ·5	3 ·0	1 to 6	1 to 6
Lime	1 ·0	8 ·0	½ to 2	5 to 12
Magnesia	1 ·0	6 ·0	½ to 2	3 to 12
Oxides of Iron and Manganese	2 ·5	13 .0	½ to 4	7 to 20
Water, Fluorine, Carbonic Acid	1 ·2	1 ·3	½ to 3	½ to 4
Specific gravity of Rocks, viz.—				
1st. Natural	2 ·65	2 ·95	2 ·4 to 2 ·7	2 ·8 to 3.2
2nd. Vitrified artificially	2 ·40	2 ·72	2 ·35 to 2 ·46	2 ·5 to 2 ·84

"'By combining the results I have obtained by chemical and mechanical analysis with those of the analyses already published by various mineralogists, I have established that igneous rocks of crystalline texture, and almost all compact or vitreous masses, formed by fusion, and wrongly considered as minerals, are derived from one or other of these Magmas. To the first are referable all the Granitic rocks, including the Eurites, Quartziferous Porphyrics, and Petrosilex, the Trachytes, Phonoliths, Perlites, Obsidians, Pumices, and Lavas, with Vitreous Felspar. To the second belong the Diorites, Ophites, Euphotides, Hyperites, Melaphyres, Traps, Basalts, and Pyroxenic Lavas.'—*Essay on Comparative Petrology, Annales des Mines*, vol. xi. 1857.

"The two outer layers of our cooled globe to which Durocher applies the terms Acid and Basic Magma, respectively, may be conveniently designated as the First and Second Layer; and in one form or another, Durocher's hypothesis is now generally accepted by physical geologists. In its chemical view of the igneous rocks it is not original, as a similar proposal to regard all igneous rocks as the result of the mixture of two types of rocks was published long ago by Bunsen, and very generally adopted by German geologists; but in its physical view of these type rocks, as the outer and inner layers of the globe, by virtue of their relative specific gravities, it is Durocher's own, and justifies his claims to be regarded as one of the most brilliant and ingenious of geological investigators. I adopt Durocher's speculation, as I do that of Laplace, as a convenient hypothesis, summing up, in a form easily remembered, a crowd of concurrent facts, and being as near an approach as the limited knowledge of man can make to probability in the obscure region of science with which it deals.

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"A consideration of the stratified rocks of the globe confirms the opinion, that carbon is to be regarded as a product of the atmosphere, like oxygen, nitrogen, and hydrogen, and not as a mineral. We are acquainted with but two important origins for carbon; viz., our coal-beds and lime-stones. The former of these are confessedly the result of vegetable organic life, and derive their origin from the vital power possessed by the Vegetable Kingdom, of obtaining carbonic acid from the atmosphere, fixing its carbon, and returning the oxygen to the air;—the latter source of carbon, limestone, owes its origin in great measure to the vital power possessed by Corals and other members of the Animal Kingdom, of fixing carbonate of lime in their

skeletons, and so gradually laying the foundation for the formation of beds of limestone. But from what source was the carbonate of lime derived? Durocher's theory of the Basic Magma supplies us with silicate of lime and magnesia in abundance; and it is certain that the decomposition of the rocks derived from this layer of the earth, by the action of an atmosphere containing carbonic acid and water, would furnish in abundance the limestones and bolomites that abound in the later periods of the earth's history.

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"In confirmation of the preceding theory, I may remark, that the absence of limestone-beds in the older rocks has attracted the notice of almost every geologist, no matter in what country they have been studied. This paucity of limestone rocks is easily accounted for, by the consideration of the fact that the denudation and erosion of the outer layer of the globe could only supply materials for the formation of slates and sandstones, and that the limestone could not be formed until the eruption of portions of the second layer supplied the lime and magnesia requisite for their formation.

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"If the foregoing views respecting the arrangement of the layers of the earth, according to their chemical composition and consequent specific gravity, be considered probable, one effect of their adoption must be to destroy the positive value of such speculations as those of Mr. William Hopkins and Mr. Hennessey as to the thickness of the supposed solid crust of the globe. These speculations are essentially founded on the hypothesis of Legendre and Laplace, that the specific gravities of the different layers of the globe depend only on the pressure to which they are subjected; and if the specific gravity should turn out to depend rather on the chemical composition of the layer than on its pressure, the law founded on the latter hypothesis would become worthless, and such speculations as I have alluded to, however ingenious as mathematical exercises, would cease to have a real value as applied to solve the problem of the thickness of the earth's crust

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"Before enquiring, however, into the origin of granite, it is necessary to inquire what granite is; and it is strange that, even on so elementary a question, there should be a difference of opinion.

"If we ask the opinion of Bunsen, or, at least, of his followers, they will tell us that granite is a mixture of ten parts of his Normal Trachytic Rock, with two parts of his Normal Pyroxenic Rock.

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"If we consult English geologists, they will give us the unsatisfactory information, that granite is composed of quartz, felspar, and mica, without stating what felspar or what mica is included in the definition, and that, if hornblende appear instead of mica, the rock ceases to be a granite, and should be called a syenite.

"And, finally, if we ask the opinion of the highest authority on this subject (Gustavus Rose), he has informed us that the presence of Oligoclase, as well as of Orthoclase, is requisite to constitute a true granite.—*Vid, Zeitschrift der Deutschen-Geologischen Gessellschaft*, vol. i. 1849.

"Bunsen's definition of granite is a mathematical fiction, the English definition has no precise meaning, and that of G. Rose is insufficient. Granite is not a mixture of two rocks; its minerals do not exclude Hornblende, nor do they necessarily include Oligoclase.

"In Ireland, which is as rich a field for the study of the igneous rocks as England is for the study of the fossiliferous rocks, we have in Leinster a granite which contains quartz, orthoclase, margarodite, lepidomelane, and a periclinic paste, as its constituent minerals. In the Mourne Mountains we have a granite containing quartz, orthoclase, albite, green mica, lepidomelane, and an undescribed paste; and in Donegal we find a granite containing quartz, orthoclase, oligoclase, margarodite, lupidomelane, and an

unknown paste. These Irish granites are quinary, and even senary, in their composition, and are as truly granites as the pegmatite of Caernarvon, which is composed exclusively of quartz and orthoclase, and is binary in its composition.

"What logicians would call the "essential difference" of granite appears to be '*a crystalline structure visible to the eye, and the presence of quartz and orthoclase.*'

"Adopting this as our definition, granites may be classified as—

1. Binary... ... Quartz and orthoclase.
2. Ternary ... Quartz, orthoclase, white mica.
3. Quaternary... Quartz, orthoclase, white mica, black mica.
4. Quinary ... α. Quartz, orthoclase, oligoclase, white mica, black mica.
   β. Quartz, orthoclase, oligoclase, black mica, hornblende.
   γ. Quartz, orthoclase, albite, black mica, hornblende."

In this classification, the author purposely omits the alleged ternary compound of quartz, felspar, and talc named Protogene—of which he denies the existence, either in the Alps or Cornwall, where it is said to occur. He dwells at considerable length on this point, as illustrative of the modes of investigations pursued in ascertaining the real constituents of rocks, which are by no means so simple as may at first sight appear. The following are the general conclusions arrived at respecting the origin of granite, which we think cannot fail to interest our readers, particularly coming as they do from one of our few English Geologists who have seriously investigated this branch of geological science.

"With respect to the igneous or aqueous origin of granite, Geologists in recent times have almost unanimously advocated the igneous theory, and Chemists the aqueous theory.

"The evidence of the Geologists has been collected in the field, and though it is wanting in the scientific precision which the Chemists have called to their aid, yet it possesses a force which all the arguments on the other side have, as yet, failed to oppose. The evidence in favour of the igneous origin of granite is essentially physical, and founded on the observation, in the field, of the manner in which granite is found to penetrate, in minute veins, every rock older than itself with which it comes in contact. It appears to me that no pasty condition of granite, such as that imagined by our distinguished honorary member Delesse, and that no aqueous solution of granite, can account for the remarkable group of physical facts which geologists have collected on this subject since the days of Hutton; and that we must admit that when granite penetrated the schists and limestones beside it, in small veins, it must have had a liquidity greater, perhaps, than that of any lava with which we are acquainted, except, probably, the siliceous lava of the Sandwich Islands. On the other hand, the arguments derived from chemistry appear to me equally unanswerable, in showing that water was present in abundance during the formation of granite, and that in some cases it is even to be regarded almost in the light of a chemical precipitate from an aqueous solution.

"Before attempting to reconcile these opposite views, let us consider for a moment the arguments of the Chemists. They are as follows:—

"I. The specific gravity of the quartz that occurs in granite is known to be 2·6, which Count Schaffgotsch has proved to be the specific gravity of silica formed by aqueous solution; while the specific gravity of silica which has undergone igneous fusion is only 2·2.

"II. Fuchs has shown that in granite we have several minerals—quartz, felspar, mica—whose points of fusion are very different; and yet they have not crystallised in the order of their infusibility, but in the inverse order, viz., of their fusibility; the most infusible of them all, quartz, having crystallised last, and acted the part of a mother-liquor to the others.

"III. Professor Heinrich Rose observes that the presence of such minerals in granite as Oligoclase, the Micas, Hornblende, &c., in presence of free silica, is inconsistent with the hypothesis of igneous fusion; as such fusion would convert these minerals into more highly silicated forms.

"IV. Lastly, the actual presence of large quantities of water (4 per cent.) in margarodite mica, which forms an important constituent of the granites of Leinster and Donegal; and the occurrence of such minerals as Allanite, Gadolinite, &c,, in the Norway granites, minerals which intumesce and change their properties on ignition; the presence of such minerals as these in granite appears to many chemists inconsistent with the theory of igneous fusion.

"Of these arguments, I confess that the first and fourth alone appear to me to be conclusive; and that the force of the second and third may be evaded by an appeal to our ignorance of the manner in which "liquation" may operate in determining the order and manner of crystallization of minerals forming on the cooling of a mixed magma, after igneous fusion. Indeed, with respect to the second argument, which requires quartz to crystallize first in granite, I am only acquainted with two rocks in which this condition has been fulfilled, by the separation of the quartz in the form of double hexagonal pyramids. These two rocks are—the felspar porphyry of Forkhill, in the county of Armagh, and the granite of Slieve Corragh, in the county of Down. The prophyry of Forkhill would be pronounced by any geologist to be a metamorphic slate, and not a fused rock, and yet it fulfils Fuchs' condition of igneous fusion, by the apparent order of crystallization of its constituent minerals.

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"The only manner in which it seems possible to reconcile the opposite theories of the origin of granite, derived from physical and chemical arguments, is to admit for granite what may be called a Hydrometamorphic origin, which is the converse of what is commonly called metamorphic action, but which might more properly be designated as Pyrometamorphic action. The metamorphism of rocks might thus be assumed to be two-fold: Hydrometamorphism, by which rocks, originally fused, and when in liquid fusion, poured into veins and dykes in pre-existing rocks, are subsequently altered in specific gravity and arrangement of minerals, by the action of water acting at temperatures which, though still high, would be quite inadequate to fuse the rock; Pyrometamorphism, by which rocks originally stratified by mechanical deposition from water come to be subsequently acted on by heat, and so transformed into what are commonly called the metamorphic rocks.

"Granite, it appears to me, although generally a Hydrometamorphic rock, may occasionally be the result of Pyrometamorphic action; and such appears to have been its origin in Donegal, in Norway, and, perhaps, in the chain of the Swiss Alps."

GEOLOGICAL SOCIETY OF LONDON.

At the meeting of February 5th, Sir R. I. Murchison, V.P.G.S., in the chair, Captain William Henry Mackesy (79th Highlanders), Waterford; Harry Seeley, Esq., Woodwardian Museum, Cambridge; and Thomas F. Jamieson, Esq., Ellon, Aberdeenshire, were elected Fellows.

The following communications were read:—

1. "On some Volcanic Phenomena lately observed at Torre del Greco and Resina." By Signor Luigi Palmieri, Director of the Royal Observatory on Vesuvius. In letters addressed to H.M. Consul at Naples, and dated December 17th, 1861, and January 3rd, 1862. [Sent from the Foreign Office, by order of Earl Russell.]

The evolution of gases,—the outburst of springs of acidulous and hot water,—and particularly the upheaval of the ground at Torre del Greco to a height of 1·12 mètre above the sea-level, are mentioned in this communication.

2. "On the Recent Eruption of Vesuvius." By M. Pierre de Tchihatcheff. Communicated by Sir R. I. Murchison, V.P.G.S.

M. Tchihatcheff's observations were made at Torre del Greco and Naples from December 8th to 25th. Near Torre del Greco several small craters (9—12) have been formed close to each other in an E.N.E.—W.S.W. line, at a distance of about 600 mètres E.S.E. of the crater of 1794; and either on a prolongation of the old fissure, or on one parallel. The phenomena mentioned by Signor Palmieri were also described by M. Tchihatcheff in detail.

3. "On Isodiametric Lines as means of representing the Distribution of Sedimentary (clay and sandy Strata), as distinguished from Calcareous Strata, with special reference to the Carboniferous Rocks of Britain." By E. Hull, Esq., B.A., F.G.S., of the Geological Survey of Great Britain.

The author, in the first place, made a comparison of argillaceo-arenaceous with calcareous deposits, as to their distribution, both in modern and in ancient seas, and stated that he objected to calcareous strata being regarded as sediments, in the strict sense of the word. After noticing the distribution of sediments in the Caribbean Sea, he referred to the relative distribution of limestones as compared with shales and sandstones in the Oolitic formations (comparing those of Yorkshire with those of Oxfordshire), in the Permian strata of England, and in the Lower Carboniferous strata of Belgium and Westphalia. After some observations on the nature of calcareous deposits, and on the contemporaneity of certain groups of deposits dependent on the oscillatory movements of land and sea, the author described his plan of showing on maps the relative thicknesses of the two classes of strata under notice, by means of isodiametric or isometric lines (properly *isopithic*, or indicative of *equal thickness* of the strata).

Mr. Hull then proceeded to show the application of the isodiametric system of lines to the Carboniferous strata of the midland counties and north of England; showing that there is a south-easterly attenuation of the argillo-arenaceous strata, and a north-westerly attenuation of the calcareous strata. The existance, in the Carboniferous Period, of a barrier of land crossing the British area, immediately to the north of lat. 52°, was insisted upon; and, although this barrier was probably broken through (in South Warwickshire) in the latter portion of that period, yet it divided, in the author's opinion, the coal-area into a north and south portion, the latter having a very different set of directions in the attenuation of its strata; the shales and sandstones thinning out eastward; the limestones in the contrary direction.

In conclusion, the author stated that, in his opinion, the sources of the Carboniferous sediments was in the ancient North Atlantic Continent, for the existence of which Lyell, Godwin-Austen, and others have argued; and he inferred that the shores of this *Atlantis*, composed principally of granitoid or metamorphic rocks, were washed on the west side by a current running S.W., which drifted the sediment in that direction; and, on the other, by a current running S.E., which carried sediment over the submerged British area.

MANCHESTER GEOLOGICAL SOCIETY.

At the ordinary meeting of January 28th, Joseph Dickinson, Esq., F.G.S., President, in the chair, the following communication was read:—

1. "On the Bank Top and Hagside Pits; and the Proving of Faults." By Andrew Knowles, Esq.

The Bank Top Collieries are about one mile from Bury, and are worked by two shafts, one of which reaches the mine at 130 yards deep, and the other at 160 yards. The mine is supposed to be identical with the Rushby Park of St. Helen's, the Arley of Wigan, and the Royley of Oldham. The Hagside Pit is 760 yards to the deep of the first of those shafts; being 280 yards in depth to the coal, and 300 to the bottom of the sump-hole: it is 11 feet 3 inches in diameter, and is used for pumping, and as a down-cast to the Bank Top Collieries, which are both up-casts. There is nothing of peculiar geological interest in connection with the mine. For many years the coal worked at Bank Top was principally to the rise of the pits, and as this was becoming exhausted, openings were commenced by driving a down-brow to the deep of the mine. When this had been driven 660 yards, a fault was met with which proved to be a down-throw, the coal being found in boring 26½ yards below the tunnel. This coal having been reached by a tunnel, driven with a dip of 1 at 1, and the driving continued 17 yards down the mine, a large up-throw was met with. The height of this having been ascertained by climbing up the vein, the coal was recovered by another tunnel, from the end of which a level was driven in the coal to where the Hagside pit would come down.

With regard to the proving of faults, the author gives the following opinion:—The dip of the coal, before you arrive at it, generally shows whether the fault is a down- or up-throw; but supposing you arrive, without any previous indication, if it is a down-fault the direction is away from you; or if up, you touch the vein first in the floor of the driving. Having found the direction of the throw, the best way to prove its extent is to go up or down in the vein, on the furthest side, so as to be certain not to miss the coal. In proving up-throw faults it is best to take two places up parallel with, and near each other, so that cut-throughs may be made easily. This insures better ventilation—gives two exits for the men in case of any ground coming together—enables the coal to be more effectually proved when reached—and generally facilitates the workings.

In a colliery where the ground is much broken, working expenses are heavier and the risks greater than where there is a clean coal to work at. But there are few collieries that are not troubled with faults more or less; and, although their disadvantages are great, they are not without some compensation. They decidedly do two things: they form an efficient barrier against water, the future utility of which may be discovered, and they keep the gas in the coal, which makes it better and freer to get.

In the discussion which followed Mr. Knowles's paper, the President made some remarks on the doubts entertained as to the identity of the Bank Top seam with the Royley or Arley mine. If they were not identical, he knew of none other that could correspond with the Bank Top except the Cannel mine.

Mr. E. W. Binney agreed with Mr. Knowles in his reserve as to the identity of the seam. Founding his views chiefly on Mr. John Hall's opinion, he thought this was not the Arley or Dogshaw seam. With regard to faults, the paper was very valuable. Geologists laid down faults with rules; but if every coal-proprietor would come forward like Messrs. Knowles, we should get some practical knowledge, and not be so inclined to draw faults in straight lines.—Mr. George Charlton suggested, that, besides forming natural barriers for water and for retaining the gas, faults might be made extremely valuable as natural divisions in ventilation. In reply to the President, Mr. Charlton also said, that, as a rule, with smaller faults the strata was not changed on either side, but with larger faults they were much changed. Some desultory conversation having ensued on the advantage of steel drills instead of those of iron tipped with steel, the discussion closed.

2. "On the Ventilation of Mines," by Mr. Joseph Goodwin.

Referring to the accident at Hartley New Pit, the author proceeded to consider how far it was safe to trust to a bratticed shaft for ventilating coal mines. Under every point of view it presented an unfavourable aspect; but was probably most at fault in its effects on ventilation. After describing the size and air-capacity of the Hartley New Pit, he asked,—If an explosion should take place where this system is practised, what hope is there for either the safety of the workman, or the employer's property?

After referring to some general properties of gases, the author again returned to the Hartley Pit, and showed that the capacity of the shaft in that case was unequal to the proper ventilation of the workings. He quoted from George Stephenson and James Mather several paragraphs against the practice of working with one shaft; which, in his opinion, not only immeasurably increases the risk to both employer and employed, but, pecuniarily considered, gives no real advantage in working a colliery.

Referring to some former observations as to sudden outbursts of gas, he wished to state that he was not aware of such having occurred in newly-opened mines, or in driving narrow work, which should be the time for these sudden emissions to take place. Are there not mines worked so as to convert the old workings into huge gasometers? We can understand that our fall of roof, or a decrease of barometrical pressure, would force the fire-damp out of these. He suggested the collection of authentic information on this subject, to enable us to understand more clearly what is meant by such a vague and indefinite term as "*sudden outbursts of gas.*"

In conclusion, the author made some general remarks as to the propriety of interfering with the discretion of the owners of collieries on the matters referred to, particularly as to the number of shafts.

In the discussion which followed, Mr. Binney said he had heard the system of trusting to one shaft condemned for twenty years. He doubted whether one shaft were cheaper than two. In Scotland, where you see a great number of these bratticed pits, the repair of the brattices is a constant source of expense. With regard to outbursts of gas, he considered that gas does come out of crevices, and it has been proved over and over again that it does come out.—The President remarked, with regard to the Hartley accident, that we would soon have the government return as to the number of pits in the country with only one entry. No doubt the system of brattice shafts has received the sanction of eminent mining engineers, but it was one he objected to. Yet it would not do for the inspectors to be too dogmatic in the matter, for the arbitration clauses left them but little power. As to the outburst of gas, at the last meeting some persons denied *in toto* that such ever took place. For his own part, he had been in the habit of going into mines daily for years before an outburst came under his notice, and he was then probably as sceptical as Mr. Goodwin. But since then he has had evidences of sudden outbursts of gas brought under his notice about which there could be no question. Within a few days of their last meeting an outburst of gas occurred in the lower Bent Mine, at Hollinwood. In the part of the workings where the inburst of gas took place, a great noise was heard while the men were at work. A man said the whole place was coming in, and the description given by the others was that it was like an earthquake. The timbers were suddenly snapped in two in the middle, and before the men could move, the gas burst up from the floor, and lighted for about 30 yards in length. There was an excellent current of air.—Mr. Wynne agreed that blowers were often made an excuse for bad ventilation, but he could bear witness to outbursts of gas coming when least expected, against which no ventilation can provide. As to the shaft question, in his opinion nothing was safe but two shafts. In some way or other accidents are sure to happen unless the shaft is duplicated. He remarked that there were only two brattice shafts in his district.—The President said there were not many in his, and some of the owners were anxious to do away with them. The Page Bank accident (Durham) where

the brattice took fire and shut up a large number of men, should have given a deathblow to brattice pits.—Mr. George Charlton said, single shafts were sunk in the North of England because of the great expense of sinking; but if the coal would not pay for sinking two shafts, it ought to remain until of sufficient value to do so. He believed Mr. Dunn was doing all he could to get two shafts. With regard to outbursts of gas, he agreed with Mr. Goodwin it would be more correct to say there had been suspension of ventilation.—Mr. Goodwin replied, that the doubt in his mind was, whether the sudden emanations of gas were such as not to be overcome by 20,000 cubic feet of air per minute, or whether they could be called outbursts below that point. He never disputed that emanations of gas took place.—The President remarked, that it was not always practicable to bring 20,000 feet of air into some places: therefore, there was nothing but the safety-lamp. —Mr. Goodwin had great objections to the safety-lamp, unless corresponding exertions are made in ventilation.—The President replied, that as an adjunct to ventilation the safety-lamp was invaluable, and the discussion closed.

On the 19th February, Mr. H. C. SALMON read a paper at the Society of Arts, (THOMAS TOPWITH, Esq., F.R.S., in the chair) "*On the Relative Merits of the Different Systems of Working Metallic Mines and Collieries.*" The paper being of a general nature, and containing no original matter, need not be abstracted here; but it led to an interesting discussion, from the report of which the following is condensed.

MR. G. R. BURNELL said that the comparative merits of metalliferous mines and coal mines had scarcely been sufficiently dwelt upon. There were conditions affecting the two classes of mines which he thought it desirable for practical men to place before the world somewhat more in detail than had been done at present, so as to get rid of some of the misconception prevalent among the public.

Then, as regarded the question of coal mines, he regretted that Mr. Salmon had not alluded to the great subject which must be present to the minds of all classes—the late sad accident at the Hartley Mine. That accident had naturally excited a great deal of feeling on the part of the public, who, under the inspiration of unpractical writers, were calling out loudly for the adoption of a uniform system of making two shafts to every mine. It was also important in these matters, that the public should be made aware that there was no universal law which could be laid down as rigidly applicable to every case. In the case of the Hartley Mine, there could be no doubt that two shafts would have prevented the fearful loss of life that had occurred, but there were cases—as for instance in the mines near Whitehaven, where the workings were carried under the sea—and where it was impossible to have two shafts. All these cases, therefore, required to be treated upon their special merits, and no universal law could be laid down; and hence arose, in his opinion, the danger of Government interference. The result of Government interference in France had been to destroy the mining industry of the country. Formerly there was a very important mining industry in Brittany—nearly as valuable as that of Cornwall—but at the present day it scarcely existed. In France no man could open a mine without a concession from the Government, and the practical result was, that whilst they were very careful to protect the lives of the people in one way, they would not allow them to gain a living in the other. In his opinion the common sense of the matter, as far as law could interfere for the prevention of accidents, was to make the persons who got the greatest benefit from mining operations responsible in purse and in person for the accidents which might arise. They talked of the impossibility (with a lease of 21 years) of enforcing a proper and costly execution of the work. To his mind that was no excuse, for if the landowner got the benefit,

he ought to be made to pay the consequences of his unjust pressure on the people who took a lease under him. In the case of the Hartley colliery, the accident, as they knew, occurred from the breaking of the large balance beam of the lofty engine. A balance beam of that size ought, in his opinion, never to be made of cast iron, and certainly ought not to be worked over the only shaft of the mine; and therein he thought the engineer was to blame. He did not believe Government inspectors could do much. Inspectors could not lay down laws to suit all cases, and they could not always see that their instructions were carried out. He was sorry to see, by the newspapers of the day, that a Royal Commission had been named. He believed a commission was not the best means of getting at the truth of such matters. The proceedings were conducted with closed doors; the evidence was not necessarily taken down in shorthand, and the whole of the evidence might not be published. He felt that, in all cases of this kind, the most proper tribunal for conducting such an inquiry was a Select Committee of the House of Commons, where everything was done openly and came before the public.

Mr. E. Chadwick, C.B., said, in respect to Commissioners, the gentleman who had last spoken was wholly misinformed, or informed only by prejudice, as to the procedure, which, when properly conducted, was the reverse of that described. The question between parliamentary committees of enquiry and commissions of inquiry was between inquiries by persons of distracted attention, limited in time to two or three hours a day once or twice a week—persons who were irresponsible, and an inquiry by persons who gave undivided attention from day to day, and who inquired by themselves or their assistants on the spot. On the more immediate topics of the paper, he could only repeat the expression of his conviction on one point, that little progress would be made in mining improvement until the whole cost, the cost in excessive sickness and excessive mortality, as well as the cost of materials in all mining adventures, were charged upon the adventurers or upon the commodity, as it was just they should be. Until the cost of ignorance of the waste and devastation occasioned by recklessness was thrown upon those who used ignorant service, due exertions would not be made to obtain educated labour, as well as superior scientific service. It was an important fact to be borne in mind, that when the causes of accidents were closely inquired into by competent persons, the great majority of them were found to be clearly preventible, the results of empirical management, or grossly ignorant labour. It was true that proprietors suffered from accidents, but not enough; not the whole cost regularly attendant upon them. A large proportion of it was thrown upon others. On the occurrence of calamities from explosive gases, the cause was frequently assigned to the recklessness of the miner, a man who, to light his pipe, would suck the flame through the wire-gauze of the lamp, or poke a hole into the gauze with his pick. The gross ignorance of much of the northern colliery population was matter of general observation. The Cornish miners had a higher degree of education, and their operations were not attended with the same proportion of fatal accidents. A friend, who was highly conversant with mining operations in every part of the country, expressed a confident belief, that had the accident of the Hartley colliery happened to a body of the better-educated Cornish miners, he was quite confident they would have worked their way out, for the distance to be cut through was stated to be not more than thirty feet. Competent inspection of the dangerous processes, combined with the principle of interest in the results, would occasion the inspector to be regarded as an ally, bringing the knowledge, derived from wide observations of experience, in aid of the owners' objects. There was an example in Lancashire of an association of the owners of steam engines, for the prevention of boiler explosions, whose mode of procedure was to engage an inspector of their own to go about and examine their several engines, and report on their defects to the owners of the engines, as well as to the Association.

Mr. P. H. HOLLAND took a different view from that of one of the previous speakers on the subject of Royal Commissions. His own opinion was, that such a tribunal, being for the most part composed of men selected from their practical knowledge of the subject, was the proper one to deal with matters of this kind. His own experience of such bodies enabled him to state that evidence was taken before a commission at greater length, and the witnesses were allowed to explain their views more fully and more deliberately than before committees of the House of Commons. The question of two shafts in all mines was one which doubtless must in a great degree be regulated by local circumstances and conditions; but he thought the Government inspectors ought to have power to order anything which was practically necessary, with a view to the prevention of accidents in mines. As the law stood at present, the inspector might give directions for a thing to be carried out, but he had no power to enforce it. What he would suggest was, that the owner should either be compelled to adopt the practical suggestions of the inspector, or refer the question to impartial arbitration. It was true, that under the present system an arbitration was provided for, but it could not be considered impartial. The owner had the power of nominating five persons, out of whom the Secretary of State selected one to arbitrate between the owner and inspector. The owner would of course take care to nominate five persons holding the same view as himself, and, therefore, so long as the present system of arbitrating on these matters existed, there was little chance of the inspector's office being a practical good. A little amendment of the law would remedy that matter, and he believed would effect a vast deal of good. After an explosion of gas in a mine it was well known that a great number of people were killed, and it was generally assumed that carbonic acid gas was the destructive agent, but that was not always the case. The great cause, no doubt, was the absence of the oxygen of which the air had been deprived by the explosion, and the men were so to speak drowned. But there was another cause of death in mines more frequent than that. There was the effects of dust. This was found to be the case to a considerable extent in the case of the Riscar explosion, by which 140 persons were killed. On examination of the bodies of several of the sufferers, it was found that their mouths were full of coal dust, by which they had been literally choked, and it appeared that others had employed their handkerchiefs, or something of that kind, to keep the dust out of their mouths. Mr. Holland next referred to the subject of the men mounting by ladders, and remarked upon the instances of great physical exhaustion he had witnessed after men had reached the surface from a depth of 300 fathoms and upwards, and he then proceeded to speak of the effects produced upon the health of miners from working in badly ventilated mines. He referred to the great prevalence of consumption among the metallic miners of Cornwall, which he attributed in a great measure to the impurity of the air they breathed, in contrast to the result upon the miners in the north, where the workings were better ventilated. In the better ventilated coal-mines, the deaths from consumption were not generally above the ordinary average of other occupations.

Mr. WM. HAWES said he believed if there was anything more likely than another to increase difficulties, it would be the admitting direct Government action and interference with mining operations, as would be the case in any other branch of national industry. But they might have a certain amount of inspection over mines, as they had over factories and over the administration of the poor-laws. That the reasonable recommendations of the inspectors, if not attended to, should bring serious results to the owners, was one thing; but to appoint a body of inspectors to whom should be delegated the authority of saying a certain thing must be done, was taking out of the hands of a great industry of this country that power of independent action without which no industry could be successfully worked. Let him apply this to the observations of some of the speakers that evening.

His friend, Mr. Chadwick, had told them that the colliers in the north were the most uneducated class, whilst the workpeople of Cornwall were the most educated class of miners. [Mr. CHADWICK—Comparatively.] But the gentlemen who spoke last had told them that, so badly were the Cornish mines ventilated, so ill-provided were they with fresh air, so little interest did the owners take in the lives of their workmen, that the mortality amongst them was higher than amongst the uneducated and ill-provided-for colliers of the North. The contradictions of those two gentlemen indicated to him that they had not proper information on which to decide the question of interference one way or the other, and no man whom they might put upon the commission, unless he has served his time in the North and the West, was fit to deal with the question. Then they had placed before them various forms in which this interference was to take place. They were to have general orders. What did that mean as applied to mines? Then they were to have a tribunal of Inspectors, and an Act of Parliament to be enforced with penalties against the owners. These were other words for crippling an industrial energy, on which depended the mining interests of the country. He was quite of opinion that they could not throw too much responsibility upon men engaged in commerce of any kind; make them responsible for any inattention or wilful neglect, or want of proper care for the lives of the men they employed, and then everything that was required would be done in the best and most economical manner. They might apply the same rule to the managers of mines as was applied to railway directors, who were made responsible out of their own pockets, and the pockets of the shareholders, and they would thus have a direct interest in the prevention of accidents. He (Mr. Hawes), therefore, said, hold the owners responsible for any cases of gross neglect, and there would be greater care to protect their men against accident than would be the case under a system of Government inspection. He would add that he never lost an opportunity which presented itself of protesting against Government interference with trade; and whilst the great accident at the Hartley colliery enlisted the sympathies of the great mass of the people of this country, let them beware that such sympathies did not lead the way to a system of Government interference which would crush the best industrial energies of the nation.

Mr. WARINGTON SMYTH, F.R.S., begged to recall the attention of the meeting to the paper of Mr. Salmon, because he thought the object of that paper had been misunderstood. If they had attended more to the varying circumstances which that gentleman had placed before them, in respect of the differing conditions of mines, he thought a very great deal of discussion upon generalities might have been avoided. If that had been done they would not have heard so much said about having more than one shaft to every mine, or the unfair comparisons between the miners of Cornwall and the colliers of the north, if they had kept before them the facts which had been introduced to their notice in the paper. With reference to the numerous shafts in some of the Cornish mines, as mentioned by a preceding speaker, it was to be recollected that many of them were mere drifts, principally undertaken for exploring purposes in metalliferous mines; there was not the certain dead expense which was attendant on the sinking of the main shafts of a coal mine, and it was frequently the case that portions of a shaft more than paid the expenses of the sinking; and Mr. Salmon had pointed attention to the fact that the entire work in a metalliferous mine was a continuous exploration. Therefore they could not look for that perfection of mechanical arrangement which they looked for in collieries, where the great expense of sinking a shaft having been once overcome, the mechanical appliances were of a character best adapted for raising large quantities of mineral with a due amount of profit. The paper embraced so extensive a range of subjects that he thought it was unfair to complain of the want of details, such as had been adverted to by one or

two speakers, and they must also remember that upon those details a great amount of importance was to be placed which could scarcely be measured by having passed before them in review the general tendency of mining operations, the object of the paper being merely to present a comparison of the two methods adopted. But with respect to some of the observations which had fallen, he must say some very strong misapprehensions appeared to be entertained in respect of some of those points: amongst others, that in mines worked beneath the sea they could not conveniently have more than one shaft, and the mines in Whitehaven were instanced as an illustration of this. He would say, having examined those mines officially, they were doubtless worked under difficulties, but were nevertheless admirably ventilated, and, as far as human prudence could foresee, were worked in a very safe and satisfactory manner; and although there might be some inconvenience in carrying a shaft through the sea, there might nevertheless be more than one shaft on the land. There were several other openings in the crop of the measures on the land, whereby the current of air produced was, in the main-air roads, almost enough to blow the spectator along. He might mention that, in Cornwall, there were several submarine mines near the Land's End which were worked under the sea at very considerable depths, and in those cases they were not satisfied with one or two shafts, but they sometimes had half a dozen, far more indeed than would be dictated by a prudent sense of economy, and which had been undertaken principally for the purposes of exploration. The paper had touched upon a great number of interesting topics, and he thought their thanks were due to Mr. Salmon for having placed before them the contrast of conditions under which the two classes of mines were worked. As regarded the last paragraph of the paper, it was an extremely suggestive one. Much might be said for and against governmental inspection. He had witnessed the gradual spread of that system—commencing with two commissioners, then adding two inspectors, who were again increased to six, and these subsequently to twelve, until they had them established in all parts of the coal-mining districts of the country. He believed a considerable amount of good had been effected by those inspectors, not so much by their actually going down into the collieries and personally introducing improvement, but because it was known that they might come at any moment, and many things were put in order with regard to ventilation and mechanical appliances which would have lingered on for years unattended to, if the owners had not had the fear of the inspectors before their eyes. He believed the extent to which the great staple minerals of the country, coal and iron, were worked, made it more important for the nation at large to look carefully into the mode in which these matters were managed. That simple question of the dimensions of the pillars, as compared with the quantity of coal removed, might not only give rise to controversy, but it was one also of considerable national importance. In districts where fuel was of the highest value, there were hundreds of acres of coal entirely destroyed, simply from the fact of those pillars not having been duly proportioned to the space of coal removed, and they could not regard this in any other light than as a national loss; but whether it was possible to introduce a supervision like that on the continent, was another question—nor did he say that he thought it would be desirable to do so. They had heard that evening of the appointment of a Royal Commission to inquire into the metalliferous mines, but he believed, unless great caution was exercised in some of these matters, as much harm as good might be done by the interference of Government, when it was not absolutely necessary. In consequence of the increasing depth and difficulty under which coal mines were worked, he thought it might be advisable that the Government should exercise a supervision to see that the mine was not exposed to danger, and on the other hand that the coal was not improperly wasted. But on the subject of accidents, he

would say, let them be very careful in distinguishing between accidents which might be termed unavoidable, and those which were the consequence of a neglect of due precaution, or the neglect of cautions given. They had confounded the two cases together too much. Cases of explosion from the want of sufficient ventilation, or from the neglect of discipline and the breaking of an iron beam which was believed to be equal to a much greater weight than it had to bear, ought, he thought, to be considered in a very different light, and the latter was amongst those accidents which human foresight could not have avoided; but the objection that had been taken to a cast iron beam, as such, was so preposterous to those who were acquainted with the matter, that he would not waste words on the subject. If they looked at the object of the paper, which was to point out the distinction between the two systems of mining, he thought they ought not to be so hasty to blame, but that something was often to be said in extenuation on account of the many difficulties under which coal-owners laboured; and from the experience he had had amongst the managers of mines, he could say there were very few indeed who were not grieved to the heart when loss of life occurred from accidents, and who did not take every reasonable precaution to guard against such accidents in future.

Professor TENNANT having made a few remarks,

The CHAIRMAN said, with regard to the various points embraced in the subject, if the hour had not been so late he should have been glad to have gone into some of them with a view of making one or two comments—not so much upon the paper itself, as upon some of the remarks which had fallen in the course of the discussion. Much had been said on the subject of commissions. Upon that point he might be allowed to speak with some little authority, having himself acted on a commission upon an important mining affair; and he must say, that that commission, and commissions generally, so far as he was acquainted with them, had been well adapted for obtaining a vast quantity of detail which could not by possibility be brought before a committee of the House of Commons. Then as to the remarks respecting the great importance of minerals, especially coal, that was a point which must be impressed upon the public in every possible way. The increasing depth and difficulty of working mines was such that it would undoubtedly force the subject very much upon public attention. Allusion had naturally been made to that most lamentable calamity at the Hartley New Pit, in Northumberland; and here he would take occasion to say, that although every one now perceived that two shafts would have prevented the fearful results of that accident, yet it was impossible, in the nature of circumstances, that every precaution against such an accident could have been provided against, or its necessity foreseen. Without entering into any details upon the prudence or necessity of a second shaft (for he, no doubt, must admit that if a second means of communication had existed it would have been more prudent) he (Mr. Sopwith) must be permitted to say that the accident, by its extent, and by the singular nature of its occurrence, was removed out of the category of those which were within the ordinary range of foresight. Much had been said about the responsibility of the owners; and here he must observe (and he spoke from an extensive acquaintance with owners and other parties connected with mines) that when an accident had happened, he did not think a greater responsibility could well fall upon them, than that severe loss of property which they suffered, in addition to that severe affliction and heavy grief which weighed them to the earth. They must not call too loudly in such cases for additional punishment. They must take into consideration the situation of those who suffered the ruin of their fortune—who like the rest of their fellowmen felt most acutely the misery and distress such occurrences produced. He would only make one further remark on this subject. It had been said that the poor men might have worked their way out of the mine. Mr.

Coulson, one of the most able and experienced men in this kingdom in the sinking of mines, was unable, with all the skill and energy of the most brave workmen, to work his way *in*; how then could it have been possible for those who were buried under the ruins to work their way *out?* Imagine a castle to have fallen. If those brave men could only move two or three feet, or perhaps as many inches, in as many hours, how was it possible for those who were buried in the cellars and vaults to work through the superincumbent mass of ruins? Many points had been alluded to in the discussion. He did not like the discussion the more because it had wandered a little from the point. He thought that was the object of a paper of this kind—to open out a discussion of the subject in all its bearings, and to obtain the opinion of different classes of minds upon it. He must, however, say a word as to the intelligence of miners in the north as compared with those in the south. Coal mining was for the most part a laborious quarrying operation, whereas working in metallic mines was of a kind to excite thought and reflection, and it was for that reason that they found in metallic mines the workmen really more thoughtful and intelligent. It was stated that in metallic mines the only means of bringing the men out was by rough mechanical contrivances, and that in Cornwall they were bringing them up without the aid of slides. He could say in all the mines under his direction the workmen were brought out of the metallic mines by slides. Mr. Warington Smyth knew that in no mines, whether coal or other, were the miners brought out in a more careful manner, by the aid of the best machinery, than in the mines to which he had just alluded.

A Personal Narrative of the Appalling Catastrophe at Hartley New Pit, January 16th, 1862. By T. Wemyss Reid. (Reprinted from the *Newcastle Daily Journal.)*

We have great pleasure in noticing this narrative of the Hartley accident, which does great credit to Mr. Reid. Any person desirous of having a permanent record of this lamentable catastrophe, and of the heroic efforts made to save the buried men, should at once get this pamphlet, which is published at the *Newcastle Daily Journal* Office, price one shilling. It is dedicated, by permission, to the Duke of Northumberland, and "represents accurately the feeling prevalent upon the spot during the long period of suspense intervening between the occurrence of the accident and the discovery of the fate of those who suffered by it; a feeling which varied every hour, and which can, therefore, only be truthfully recorded by a contemporaneous record."

What is Good Iron, and How is it to be Got? London: John Murray, Albemarle Street.

This is an anonymous pamphlet, but it is evidently written by one well acquainted with the generalities, at least, of the iron-trade. It opens with the question that gives the title to the pamphlet—"What is good iron, and how is it to be got?" To which the author adds—"The conviction is daily gaining ground that by the penny-wise and improvident use of inferior qualities of iron, much capital has of late years been wasted and much risk incurred."

Upon this text he expatiates with considerable force, and in a vigorous and popular style. He explains the deterioration in the quality of the iron which has resulted from the introduction of the hot blast, and above all the use of the cinder as in iron-ore; and shows how the pressure of competition is daily aggravating the evil, Not that he denies the importance of cheap iron for the development of modern civilization, which he admits will be found, for many purposes, to answer as well as the best; but he points out how this mania for cheapness is gradually driving thoroughly good iron out

he market, so as to render its being procured, even when required for most vital purposes, a matter of extreme uncertainty if not difficulty. Thus, then, the year 1862 opens with the paradoxical condition of the trade, which we have endeavoured to explain by tracing the steps by ch it has been reached. No blame is imputed to the manufacturers as ody, who have only obeyed the laws which regulate all commercial sactions. It would be foreign to the purpose to note the struggles of viduals who have held a course in opposition to the current of the times: have to deal only with general results. On the one hand we see a rapid ension in the use, and therefore in the production of first-class iron; lving a complete change, material and moral, in the iron trade. On other hand, we find a reaction in favour of the best iron, which, though has hardly yet advanced beyond words. The public have discovered for certain purposes of great importance, the substitution of cheap for good is a failure, but the pressure on the manufacturers is not yet iently strong to divert them from the policy and practice of years; and e it is that, amidst all the talk about first-class iron, the demand for s not increased. This circumstance is favourable at least to those who re to be purchasers. But it is scarcely possible that Government should l itself of the opportunity. No Government can act with the energy decision of an individual trader. It lacks central motive power. It is ge giant, rendered helpless by the feeble and defective action of the t. The question is not only, What ought Government to do? but, How h can it do of what it ought?"

ow the author proposes that these difficulties may be met, particularly e case of iron intended for Government use and the national defences, must refer those interested in the subject to the pamphlet itself.

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e "Journal of the Chemical Society" is now published monthly, ad of quarterly as hitherto. The January number contains two papers rofessor Bolley, which may be of interest to our readers: the first is, ome *Physical Properties of the Alloys of Tin and Lead;* and the second ribes some *New Experiments on the Dangers arising from the use of ain Waters for feeding Steam Boilers.* The first paper is of considerable est; but as it will scarcely bear condensation or abstraction, we must our readers interested in the subject to the "Journal" itself. The nd is of more immediate practical importance, as it indicates a source nger to steam-boilers not before suspected. Hitherto the danger of sits from the feed-water of steam-boilers was supposed to be confined *lphates* of lime, &c., which form a stony incrustation; *carbonates*, which d only a pulverulent or muddy deposit, not being observed to create inconvenience. In consequence of numerous disturbances to certain rs at Zurich in Switzerland, samples of the feed-water were sent to the essor for examination, which he found to contain principally carbonate me, *sulphate being entirely absent.* This absence of what had been idered as the main source of danger, while accidents were of frequent rrence from the use of water containing chiefly carbonates hitherto ned innocuous, naturally led to careful enquiries. The result of these, h are given in this paper, show that the evil was due to the presence certain proportion of *fatty* matter. The effect of the combination of fatty matter with the carbonate of lime was to form in the boiler a pulverulent deposit *which swam on the surface of the water and did not ne wet.* This deposit, which was thus kept floating, completely covered heated surface of the flue, so as to prevent the water coming in contact it. The original source of this fatty matter does not seem to have been rtained with certainty, but its presence was probably owing to the r supplied to the boiler being taken from the condenser of another ne. The evil was remedied, on the advice of the professor, by the

addition of a small quantity of *carbonate of soda*, which combined with the fatty matter to form an alkaline liquid; the result being that the pulverulent carbonate, thus freed from these fatty matters, were at length thrown down. We think there can be no doubt that the investigations recorded in this paper are of considerable practical value, for they point out a source of danger not hitherto suspected, and certainly show the necessity of great care in endeavouring to avoid, as much as possible, supplying boilers with water likely to contain fatty matters even in very small quantities—such, for instance, as they might take up by being used for condensing.

The following is from the *Times* City Article of the 26th February. It is difficult, at the moment, to foresee the effects of this extraordinary production of mineral oil, but it certainly threatens to revolutionise certain branches of industry.

The production of oil from the springs in Canada and the United States continues on a scale far greater than the means of transport. At present the refining trade as regards this product seems in a state of only partial organization, and the difficulties and cost of conveyance delay its development. Every fresh account, however, seems to indicate that the supply is virtually illimitable, and that the result will be the growth of a new business, which, for rapidity and extent, will be such as has rarely been paralleled in the history of commercial changes. Hitherto the arrivals in Europe have not been large; but a vessel has just discharged 5,000 barrels in Victoria Dock, and several additional cargoes are daily expected, both here and at Liverpool. The New England houses are gradually withdrawing themselves from the sperm oil trade, with the view of investing their capital in the establishment of refineries (a change in which they have been assisted by the opportunity of selling some of their old vessels to the Government for the stone blockade at Charleston) and they now appear to have commenced making consignments, especially from Boston, with some degree of regularity. To check this competition the Paraffine patent owners in the United Kingdom have commenced a suit in Chancery to prevent the use of that name for the American manufacture. The article, however, must be wholly independent of the name under which it is offered, and will find its market solely according to its claims on the score of quality and cheapness. An increase of purity is being constantly effected by the daily experience from its enlarged manufacture, but the question of price cannot be tested until the requisite facilities of transport shall have been established. The prime cost at present is actually almost nominal, but there are 30 miles of bad roads to be traversed before the oil can be placed on the railway either for New York or Boston, and the expenses and difficulties of cartage are enormous. The hardening of the roads by a sharp frost will occasionally make all the difference between very large profits or a direct loss to the wellowners. Lately, the oil has been sold at the wells for a sum equal to 1s. per barrel, and an instance is mentioned of a lot of several hundred barrels having been disposed of at 11s., barrels included. Under such circumstances it is only the wells that flow spontaneously to the surface that can be worked at a profit; but these yield a seemingly inexhaustible quantity. In the course of less than half a year, however, direct railway communication, both in Canada and Pennsylvania, will, it is said, be established into the heart of the principal regions. In Canada the directors of the Great Western line are directing their attention to the requisite measures, and in Pennsylvania an extension of the Atlantic and Great Western line, which connects with the Erie Railway to New York, is stated to have been already commenced to the principal seat of the business, with the certainty of completion in the course of the ensuing spring. Meanwhile the entire district, which a few years back was little more than a wilderness, is becoming thickly peopled, notwithstanding the interference of the war

th commercial operations of all kinds. The following are the latest rticulars given in the Philadelphia journals :—

'The coal oil of Pennsylvania is rapidly becoming one of the important elements ur industry and wealth. It is scarcely three years old, and even now it bids fair rival the coal trade itself. The following statement of the shipments on the ladelphia and Erie Railroad alone will give a comparative idea of the increase of trade :—In 1859, 325 barrels; in 1860, 21,794 barrels; in 1861, 134,927 barrels; le for the first month of 1862 the total shipments on this road have been estimated 0,000 barrels. Large as the business and the increase on this railroad has been, estimated that it shows but little more than one-sixth of the business actually e. Large quantities of the oil were taken to Pittsburg by way of the Alleghany er, and thence to Philadelphia by the Pennsylvania Railroad. The Erie Exten- Canal carried large quantities to Erie, whence it found its way to the Eastern ket by the lake and the railroads in North-western Pennsylvania. It is stated good authority that the well on Oil Creek yields 75,000 barrels of crude oil per nth, which would be 900,000 per annum. What the yield of the whole oil region his State will be during the present year cannot be definitely ascertained, but it t reach very considerably over a million barrels of crude oil, for new wells are tinually being opened, and the trade is making the most astonishing strides, and mises greater wonders still. It has no parallel in this country or in the world, ept the Californian gold fever, which it rivals in speculation and excitement. e crude oil, it is said, involves an expense of about $10 per barrel in purchasing rels, transportation, refining, &c., so that the actual expenditure on 1,000,000 of rels would be $10,000,000 per annum. The region of country in which such mense wealth is now being developed was, before the excitement caused by riking oil,' comparatively thinly populated, and much of it a wilderness, but now it ecoming thickly settled, and new towns are springing up, and old ones growing greater proportions. This will make that section one of the most flourishing in commonwealth, while all the oil seeking an Eastern market and an outlet for rope must greatly benefit and increase the trade of Philadelphia, the emporium he State."

Notes, Queries and Correspondence.

[WE need scarcely say that we cannot hold ourselves responsible for the facts or opinions of our correspondents; although we shall make it a point to endeavour to exclude those who are obviously inaccurate or fallacious, as far as is consistent with our wish to encourage the freest discussion.]

NAPIER'S COPPER-SMELTING PROCESS.

SIR,—Permit me to reply in few words to a letter in your last number gned "An Old Copper Smelter." The author of that letter is neither so l in years, nor so experienced in the art of copper-smelting, as his *nom de me* would lead us to infer. The dates of his birth and death in the pper-smelting world are well known; and the period comprised between ese events was too short to justify the assumption on his part of the title Old Copper Smelter." It is obvious that he has an almost *parental* affection r Napier's process; and therefore any judgment which he may pro- unce in its favour must be received with that caution which, in his ter, he properly declares to be necessary in the case of "interested atements."

The "Old Copper Smelter" asserts that "on some of the practical parts, rticularly in reference to the smelting of the ore, it (my work on Metal- rgy) is defective, and shows, more than anything can, that if metallurgy to be studied properly, it must be done at the works, where the practical erations are conducted." Now the particular part of the work here ferred to was revised in type by one of the best educated and most perienced smelters in the kingdom.

The "Old Copper Smelter," under the protection of his anonymous signature, ventures to intimate that I am wilfully blind to the merits of Napier's process, and have allowed my judgment respecting it to be influenced by personal considerations. I have only to observe in reply that the man who thus imputes unworthy motives to others will generally be found to deserve the imputation himself.

The complaint of the use of "*sic*" is perfectly just; and I much regret that I should have been guilty of verbal inaccuracy in the quotation. I have inadvertently omitted the words, "samples taken out and," which should immediately precede the word "tried."

I am accused of unfairness in my remarks on Napier's experiments upon the calcination of the charge of Cuba ore. My reasoning is based on Mr. Napier's own analytical data, and if my conclusions be erroneous I should be glad to see them disproved.

Whether Napier's process should be regarded as a success or a failure, your readers will be enabled to judge from the admissions contained in the letter of the "Old Copper Smelter." It is certain that the copper smelters have not yet become convinced of its value, for otherwise they would not have allowed Mr. Napier recently to obtain an extension of his patent without opposition. Mr. Napier would, if I mistake not, be the first to admit that a metallurgical process cannot, in many cases at least, be satisfactorily tested by experiments in a laboratory, as it is often impossible to fulfil conditions on a large scale which may be easily secured on a small scale. A chemist, therefore, who should pronounce from experiments in crucibles that tin, antimony, and arsenic might be completely separated from copper ore by Napier's process, in furnace operations on a large scale, would assuredly be guilty of imprudence. I have confessed my doubts as to the precise causes which led to the discontinuance of Napier's process; the balance-sheets of the establishment would probably afford a satisfactory explanation. It is alleged that I am in error in stating that Napier's process at the Spitty works was replaced by the ancient method of copper-smelting. The manager of the works personally informed me that such was the fact; but I may have misunderstood him. However this may be, the really important fact remains:—Napier's process was abandoned.

In publishing the report concerning the alleged excess of copper on the furnace bottoms at the Spitty works, it was not my intention to convey the impression that this was especially due to Napier's process, and I regret that I could have been misinterpreted on this point. My object was simply to shew that estimates in such cases are to a great extent guesswork, and ought never to be received with implicit confidence. I know one of the persons who was engaged in making the estimate: he is a most experienced smelter, and an honourable man,—a man quite incapable of falsifying an estimate from unworthy motives, as the "Old Copper Smelter" insinuates.

The "Old Copper Smelter," would act wisely in future not to judge others by himself, and impute motives which have no foundation except in his own imagination.

I remain, Sir,
Your obedient servant,
JOHN PERCY.

School of Mines,
February, 1862.

OXLAND'S PROCESS.

SIR,—In the interesting account contained in your first number, of Oxland's process of separating wolfram from tin, the chief agent employed is stated to be "*soda-ash.*" If this is not an error, I must certainly agree with your correspondent "Chemist" in readily accounting for a loss of tin

in the form of stannate of soda. Oxland's process, as it is described in Bruno Kerl's Metallurgie (for I have not at hand his patent specification), is accomplished by means of salt cake (*sulphate* of soda), and should give very different results.

A mixture of wolfram and tin oxides, fused with sulphate of soda, or better, bi-sulphate of soda, would give a soluble tungstate of soda, which might be extracted with hot water, leaving oxide of tin unsoluble. Kerl's description is as follows:—

Sulphate of soda and coal slack is added to the tin witts in fine grain, and thinly spread out on the hearth in proportion, according to the per centage of wolfram. The mixture is at first heated with a smoky (reducing) flame, then with a strong oxidizing flame, in a reverberatory furnace with an iron bed. Tungstate of soda is formed, and sulphur and iron separated the tin stone remains undecomposed. The charge is then exhausted with hot water, and freed from the tungstate of soda, which is utilized in certain chemical establishments; the rest is washed to free it from oxide of iron.

These re-actions are confirmed also by H. Rose, in his work on Analytical Chemistry, and would, I believe, give much more satisfactory results than the process which with soda-ash produces *two* soluble salts.

Yours truly,

WILLIAM BAKER.

It is curious to remark the traces of the Germans in our smelting and mining works. The word "tin witts" was new to me, but I recognize it in the Zinnzwitter used to denote a mixture of tin stone and other minerals: Zwitter=hermaphrodite (mongrel).

W.B.

Lead Works, Sheffield, February 7th, 1862.

THE GREAT WHIN SILL.

DEAR SIR,—As I observe, in the January number of the Mining and Smelting Magazine, that you intend opening a department of Notes, Queries, and Correspondence, I therefore beg the privilege of asking for opinions relative to the following queries:—

1. Has the Great Whin Sill of the North of England been spread over the area which it now occupies by submarine lava currents?
2. How, or in what manner, was it likely that the molten matter would find its way through the solid crust?
3. From what point, or points, on the area of the lead-mining district was it erupted?

Replies to the above will much oblige,

Your very obedient Servant,

JOHN CURRY.

Feb. 22nd, 1862.

Mining, Quarrying, and Metallurgical Intelligence.

CORNWALL AND DEVON.

In the *Gazette* of the 18th of February, it was announced that the Queen had been pleased to appoint the Right Hon. Lord Kinnaird, K.T., the Hon. Fulke Egerton, Nicholas Kendall, Esq., Henry Austin Bruce, Esq., John St. Aubyn, Esq., John Davie Furgnson Davie, Esq., Edward Headlam Greenhow, M. D., and Philip Henry Holland, Esq., to be her Majesty's commissioners to enquire into the condition of all mines in Great Britain, to which the provisions of the Act 23 and 24 Vic., c. 151, do not apply, with reference to the health and safety of persons employed in such mines.

The appointment of this commission, to enquire into the condition of the metallic mines of Great Britain, has been for some time expected, and consequently its nomination excites no surprise. Its composition is no doubt very fair; and the metallic mining interests of the country may, we are assured, anticipate an impartial and unprejudiced enquiry at its hands. At the same time it may be well to remind those interested in metallic mines that this commission must arrive at its conclusions *from the evidence placed before it;* and that consequently they must bestir themselves so as to bring forward the real facts, and not to allow one side only to be heard. It is no doubt true that mining is not the most healthy pursuit a man can follow; but we are quite satisfied that its unhealthiness has been enormously exaggerated by certain well-meaning, but fussy and half-informed people. It is the duty of those most interested in mining to take care that this class of busy-bodies does not manage to gain exclusively the ear of the commission, and make it merely a medium of giving an official stamp to their theories.

Certain figures regarding the rate of mortality among metallic miners have for some years been freely circulated among the public. Those acquainted with the subject are aware that these figures do not represent *facts* but *theories*. It is notorious that an ingenious man can prove any thing by figures, by selecting those that suit him, and suppressing those that do not—the process followed in this case. We have much pleasure in noticing the following letter on this subject, in the *West Briton*, from Captain Charles Thomas, of Dolcoath.

"Much having been recently said and written on the diseases and the length of the lives of Cornish miners, the attention of thoughtful men has been directed to the consideration of that very important subject.

"Your readers will at once admit that it is essential to the arriving at truth, in this as in any other matter, that sufficient data should be obtained. in order to which I beg to suggest the propriety, indeed the necessity, of having answers to the following questions:—

"Firstly. The number of persons working underground, with their ages, in any district comprising several mines.

"Secondly. The number and ages of those who did work underground, and who are now employed as mine agents, pitmen, timbermen, enginemen, and other engagements on the surface of the mines in the same district.

"Thirdly. The number and the ages of those who formerly worked underground in that district, who are now engaged in some business, keeping small shops, cultivating small farms, &c.

"Fourthly. The number and ages of those still living who have emigrated to our colonies, or to foreign lands within the last 20 years, and of those who have returned from fields of successful enterprise.

"I doubt if any class of labourers on the earth has so large a proportion as the Cornish miners who move out of the sphere they have been trained in, to occupy improved positions in society, and by emigrating to endeavour to benefit themselves and their families.

"If this important matter be fairly looked at in the light which can be had in the way indicated above, I am inclined to think the average length of the lives of miners in the Camborne district, and in some others also, would be found to be little short of 40 years, instead of 30, as given by some who have only taken a partial view of the matter."

The testimony of such an experienced, and at the same time such a candid and impartial man as Captain Charles Thomas, that the average of life among miners is 25 per cent. greater than is stated to be the case by those who take "a partial view of the matter," shows, at least, how uncertain our knowledge is at present. The enquiries of this newly-appointed commission, if conducted judiciously, and if aided by those best able to afford authentic information, ought to give us conclusions on which at least we can rely.

In the WENDRON tin district, mining is progressing steadily, although without any very striking features. At *Wendron Consols* the mine is generally looking very well; and now that the heavy dead works, recently carried out, are completed, a resumption of dividends may be speedily expected. At Hills, the shaft is sinking below the 80, by 6 men. At Bal Dees, 9 men are sinking below the 35, and in a short time it is hoped that this important part of the mine will be opened up; the new engine, which has been recently erected here, works exceedingly well. At Bishops, the shaft is sinking below the 52, by 6 men; the lode is improved, and this part of the mine generally looks well. At Wheal Fat, the shaft is sinking below the 15, on a large lode; this part of the mine is very promising, and looks likely to open out well. In the 15 driving west on Wheal Fat lode, tin is expected when this lode makes a junction with Richard's lode, about 20 fathoms further west.

The adjoining mine, *Wheal Basset and Grylls*, looks extremely well. The 32 is being driven east and west on Wheal Fat lode, in a large and good lode; but the 16 and 23 ends here, on the Caunter lode, are driven to Wendron Consols boundary, where the lode is large, with a kindly appearance. At Wilkins, the lode is improved, and when this is cut at Tyackes, there is every reason to expect something good will be met with.

At *Wendron United* the new south lode is 3 feet wide at the 30, and is opening out very fair. This is very acceptable, and indeed may be the salvation of the mine. *Garlidna* has been very expensive at surface; if money is now spent underground, the mine will doubtless do by and by. *Trevennen and Tremenhere* is poor, and likewise *North Trumpet*. *Treworlis* is also poor, but a good stone of ore has been lately cut.

Although, as will appear from the above, the Wendron district is not at present flourishing in any very brilliant manner, there can be no doubt whatever that, with sound practical and economical management,—management acquainted with the district,—combined with a good price for tin, it will become one of the most productive in the county for tin.

The continued fall in the standard of copper ore during the last month has naturally created rather a gloomy feeling throughout the county. The deep mines of West Cornwall are so dependent on a high price for their ores, that a continued fall must seriously affect those that are the greatest employers of labour. Every one seems to have decided that, until the American affair is settled somehow, a revival of trade and consequently an advance in the prices of metal is not to be expected. We fear this is the case; but it is to be hoped that the desired time is not so far off as it may seem at present.

WALES AND THE BORDERS.

FLINTSHIRE.—A melancholy accident, which has resulted in the loss of sixteen lives, occurred at Bryn Gwiog Mine, on the Halkyn Mountain, near Mold, Flintshire, on Wednesday, February 12th, between 9 and 10 o'clock in the morning; the men, to the number of 27, were at work as usual, when a sudden in-burst of water took place, which rapidly filled the mine to the upper levels. The source of this water is not at present positively ascertained; but it is supposed to have come from some old workings which were cut into at the bottom of the level. There was no suspicion of there being any workings at such a depth, and consequently no precautions which could have been taken would have availed to prevent the lamentable catastrophe. As the matter is at present under investigation we shall say no more on it until the result of the inquest is known. A subscription, which has now reached £1,000, has been liberally contributed by all the leading local gentry and miners. The Marquis of Westminster contributes £100, and the Bryn Gwiog shareholders £200. It has been stated in some of the papers that the water cut here was that of the old Hendre mine, formerly one of the richest mines in the North Wales district; but such is not the case. The Hendre mine is nearly a mile away, and the surface there is much lower than the bottom of Bryn Gwiog, so the water would have to run up hill to reach the latter mine.

SOUTH WALES.—The official returns of the export of iron and coal at the port of Cardiff, for the month of January, have just been published. As compared with the corresponding months both of 1861 and 1860, there is a considerable decrease. The exports are as follows:—

	1860.	1861.	1862.
Coal......	94,887	101,747	101,024
Iron......	8,617	10,223	8,416

The following are the returns of the over-sea shipment of coals from the ports in this district during the month of January:—

Cardiff.—101,024 tons of coal, and 310 tons of coke, in 90 British and 190 foreign bottoms; corresponding month of 1861, 45 British and 239 foreign ships carried 101,747 tons of coal, and 601 tons of coke.

Swansea.—41,316 tons of coal, carried in 53 British and 149 foreign craft; in the corresponding month, 27,832 tons of coals, 70 tons of coke, were exported in 29 British and 107 foreign ships.

Newport.—16,875 tons of coal, in 13 British and 22 foreign ships; corresponding month, 20,160 tons of coal, in 16 British and 31 foreign vessels.

Llanelly.—9,546 tons of coal, in 25 British and 29 foreign ships; in the corresponding period last year, 24 British and 31 foreign vessels conveyed over-sea 8,325 tons of coal, and 620 tons of coke.

A terrible explosion occurred on Wednesday, the 19th February, at the Cethin Colliery, near Merther Tidvil, the property of Mr. William Crawshay, by which 47 men were killed. The cause of the explosion has not yet been ascertained, but it is being rigidly investigated by the Government Inspector, Mr. Evans. It is supposed to have been caused by a "blower" of gas, and, on all hands, it seems to be admitted to have been an unavoidable accident, for the pit was thoroughly well ventilated, and was generally held to be a tolerably safe one. An explosion occurred in the same pit about 10 years ago, but then, fortunately, without loss of life. Of the 47 who perished, 21 died from burns, and 26 from suffocation by choke damp. The investigation of this explosion may throw some light on the vexed question of sudden outbursts of gas, which has been recently so keenly debated, particularly at the Geological Society of Manchester.

NORTHERN COUNTIES.

Hartley catastrophe has absorbed all attention in this district for ıst month. The verdict of the jury and the result of the enquiry are 'ell known in every corner of the kingdom to require recapitulation.) the immediate cause of the accident, the breaking of the beam, was undoubtedly brought about by the breaking of the pump ır" or "rod," in consequence of the bucket getting fast in the pump s the engine commenced to make her strike. Hence the *original* cause) accident was a defect in the pit-work. How the breaking of the ır" led to the breakage of the beam is involved in considerable ob-y; but it seems that when the spear broke, the beam sprang in with) force, breaking in the concussion. That under such circumstances am, if of proper construction and placement, should not have broken, e clear. But it seems to have been originally badly proportioned, ; too much metal about the centre; and besides, the gudgeons seem e been keyed too tight. Still the beam, notwithstanding these defi-s, might have borne the shock of it, had it not been for the frosty ır, which had affected the iron.

secondary cause of the lamentable loss of life accompanying this t—the absence of a second shaft—has more impressed itself upon blic mind. In the foregoing pages of this number, our readers will he opportunity of reading the various opinions expressed on this t, by competent persons, at the discussions of the Society of Arts and ological Society of Manchester.

of the numerous issues arising out of an occurrence which has so . the public mind, is the notion which has sprung up of making em-s pecuniarily responsible to their workmen for accidents. This has a tangible expression in the Bill which Mr. Ayrton has brought the House of Commons. A recent number of the *Colliery Guardian* ı admirable article on this subject, which we make no apology for re-ıg, particularly as we are satisfied, from certain statements made at eting of the Society of Arts, on the 19th ult., that the question is m being generally understood.

bill introduced into the House of Commons by Mr. Ayrton, to "amend the ating to the recovery of damages by workmen and servants, and of compensa-r the families of workmen and servants killed by accidents," is remarkably nd is also remarkably comprehensive, for, if sanctioned by the legislature, it y materially increase the responsibilities of all classes of employers. As the w stands, employers are bound to provide suitable and sufficient machinery, us, or tackle for the proper and safe carrying on of the works they have ken, and if any servant shall suffer injury while engaged in his proper n through the imperfection or inadequacy of the apparatus provided for him, ployer is liable for damages, and if the servant shall have been killed his ntative is entitled to compensation. This is reasonable, and just, for, as the er undertakes to provide proper machinery or tackle, and the servant accepts tion on this implied condition, the arrangement is equitable, and both parties be bound to fulfil their several parts of the contract. Further than this, an er is responsible for the actions of his servant so far as they spring out of the ance of his duties, and as they affect extraneous parties. Thus, if a boat-n his boat against another through carelessness, and thereby cause serious ı to that other boat, the employer of the boatman is in the first place respon-r the damage sustained. A master, however, is not answerable for the wilful his workman, nor for any acts done beyond the scope of his employment. ' is he responsible for injuries sustained by one servant through the mis-; or negligence of another servant. These principles are of so much import-; the present time that it may be expedient to explain them more fully, and e aid of higher legal authority than we can bring to bear on the subject. Mr. , in his admirable work on "Collieries and Colliers," explains with remarkable and clearness the law bearing on the responsibility of employers for injuries d by their servants. He says that if the negligence or unskilfulness of the

employer himself causes an injury to a person engaged in the business, the former is responsible for such consequences. It is also established that a master is liable to third persons for any injury or damage through the negligence or unskilfulness of a servant acting in his master's employ. The reason for this is, that every act which is done by a servant in the course of his duty is regarded as done by his master's orders, and consequently is the same as if it were the master's own act. He is also bound to take all reasonable precautions for the safety of his servants. Thus, if hidden and secret dangers exist upon his premises, known to him and unknown to his workmen, it is his duty to disclose them to the latter, that they may take precautions for their own safety, and if he neglect to do so he is responsible for any injury they may sustain through their ignorance. This rule implies an obligation on the part of the employer to exercise due vigilance, either himself or through competent servants, for the purpose of detecting any unsoundness or imperfection in the machinery or apparatus employed by him. A colliery owner, would be culpable if he induced any man to go down his pit under the persuasion that the rope and other parts of the winding tackle were safe, when he himself knew, or had reasonable ground for believing, that they were dangerous. We are not aware that there is any specific provision requiring the master to employ competent persons as subordinate officials, but from the general tenor of the law there can be no doubt that if in any case it could be proved that a servant had sustained personal injury through the incompetence of a superior servant who was authorised to direct him, damages would be obtained in one of the superior courts. Here, however, the responsibility of the employer stops. It has recently been decided more than once, by the very highest authority, that a master is not responsible for injuries to one fellow-servant caused by the negligence of another fellow-servant in his employ. In the celebrated Barton's Hill case, which was taken to the House of Lords, this principle was affirmed. Lord Cranworth, in giving judgment, spoke of the responsibility of employers for injuries done to third parties, and then proceeded to ask whether the same principle applied to the case of a workman injured by the want of care of a fellow-workman engaged in the same work. His Lordship decided in the negative. When, said he, the workman contracts to do work of any particular sort, he knows, or ought to know, to what risk he is exposing himself, and among the perils he has to encounter are those arising from want of care or judgment on the part of his fellow-workmen. As these cannot be averted by any precaution that his employer can adopt, he deliberately accepts the risk in consideration of the wages he has to receive. In the case of "Griffiths v. Gidlow" the same principle was upheld, and the decision was to the effect that as the injury sustained by the plaintiff had not arisen through any fault of the employer, but through the negligence of a fellow servant, the defendant was not responsible. Indeed, when we carefully consider the matter, it is somewhat surprising that any litigation should have arisen for the purpose of fixing upon employers the responsibility of accidents to workmen arising from the negligence or misconduct of their fellow workmen, for the principles of English law, as applicable to this question, are the principles of common sense and justice. If workmen are to be treated, not as children needing constant protection, but as rational men, able to make bargains for themselves, they ought to abide by any arrangement which they deliberately accept. In a contract of service between a colliery owner and a hewer, the former undertakes to safely convey the latter to and from the surface and the bottom of the shaft by providing adequate winding tackle; he also undertakes to keep the mine in a proper state of ventilation so far as may be practicable, and also to employ suitable and competent men as officials. On the other hand, the working collier, knowing the risks of his vocation, accepts them on condition of his receiving the wages usually paid in the district. If any accident should accrue to him through insufficient or unsound tackle, or through bad management of the mine, the employer is responsible, and may be amerced in commensurate damages; but on the other hand, he and his fellow workmen are to a certain extent independent of their employer. They are subject to general and special rules, which the law has undertaken to enforce, but if any of them so misconduct themselves as to injure their fellow servants, they must all abide the consequences without reference to the employer, who, as he had nothing to do with producing the disaster, cannot fairly be charged with any responsibility connected therewith.

Such is the law as it now stands, but Mr. Ayrton, sustained by Lord Robert Montagu, proposes that hereafter whenever any workman or servant shall be injured in consequence of his master, or any other person employed by his master, not doing.

lost their lives. The verdict, at the conclusion of the inquest, declared
: had been an outpouring of gas at a certain part of the mine, which was
ithin very narrow limits, and that the gas must have been ignited through
tious use of a naked light by the workman employed there. Had Mr.
law been in force then, the unfortunate proprietors would have been liable
on for compensation from the representatives of each of the deceased, and
actions been raised, strong evidence would have been adduced to prove that
sion was caused through the negligence or misconduct of a fellow workman.
of lives are lost every year through want of sufficient propping, and it
happens that one man's life is sacrificed through the negligence of another
be working in the same place, and if Mr. Ayrton's bill were to become
tudes of cases would arise of colliery owners being charged with the
lity of deaths accruing under such circumstances. Sometimes it happens
rs when ascending the shaft are drawn up to the pulleys and thrown out
skets or tubs, all through the negligence of the engine tenter,—colliery
ould be liable to damages in these cases, though nobody can suppose them
ally accountable for casualties arising under such circumstances. Boiler
may generally be traced either to imperfect materials or the bad ma-
; of the persons charged with the duty of attending to the boilers; but by
sed law the owners of the boilers would be liable to actions for damages
nsation for the injury sustained thereby. We might go through a complete
causes of colliery accidents, and find in each an illustration of the way
the new bill, if it became law, would affect the interests of colliery owners.
noted, that damages are to accrue not only from death but from injuries,
nan who is acquainted with the working of a colliery will at once appre-
it a boundless field would be opened for vexatious litigation and ruinous

When an accident occurs to an excursion train, and a number of people
ly, though perhaps few are dangerously hurt, it is the business of the
ompany's local manager to visit all the sufferers as quickly as possible,
ge the terms of compensation. Delay in such a case is dangerous, for in
trict there are benevolent attorneys ready to espouse the cause of the
ithout any prospect of payment beyond what is to be derived from the
ness of vindicating the poor and the hope of participating in damages,
ication to collieries of any such law as that relating to compensation for
ccidents would create endless quarrels and confusion, and eventually close
the collieries in the kingdom.

; not be imagined that the benevolent project of Mr. Ayrton will affect
sts only of colliery owners, for there are very few employers in any of the
nches of industry who would not be victimised by its provisions. The case

once hazardous to property and perilous to life. We need not, however, dwell on this point, for the sketch we have given of the actual state of the law proves that the legislature has taken all reasonable precautions within the scope of its jurisdiction for the prevention of accidents to workmen through the parsimony or heedlessness of employers. The scheme now proposed is one of a series of measures, the total effect of which would be to virtually confiscate a large amount of the capital invested in collieries and other analogous undertakings. We believe its only chance of success will spring from a misconception of its real import, and, therefore, we trust that all who comprehend its true character will be at once energetic and vigilant, and thereby procure its prompt and summary rejection.

Mining, Quarrying, and Smelting Accounts and Meetings.

CORNWALL AND DEVON.

At Great Wheal Fortune (Jan. 22), a dividend of 10*s*. per share was declared, and a balance of upwards of £900 in favour of adventurers carried to next account. The report of the agents was an exceedingly satisfactory one.

At the Alfred Consols Mine (Jan. 27), the accounts for September and October showed—Balance last audit, £279. 11*s*. 2*d*.; mine cost, merchants' bills, and sundries, £1,891. 7*s*. 10*d*.=£2,170. 19*s*.—Copper ore sold, £1,495. 8*s*. 8*d*.: leaving a debit balance of £675. 10*s*. 4*d*.

In consequence of the notice given by the Great Wheal Alfred adventurers to the lords, offering them the materials and the mine, that mine will, most probably, soon cease to work; it is, therefore, resolved that when the result of the answer from the lords be ascertained, that Great Wheal Alfred is certainly condemned, the committee be requested to call a special meeting of the adventurers in this mine, to determine on the future working, and to fill up the vacancies at present in that body. The purser was instructed to take legal proceedings against all in arrear of calls.

At South Caradon Mine (Jan 28—Mr. R. Kittow in the chair), the accounts for the two months ending October showed—Balance last audit, £3,040. 3*s*. 6*d*.; copper ore sold, £9,122. 12*s*. 5*d*.=£12,162. 15*s*. 11*d*.—Mine cost, merchants' bills, and sundries, September, £3,135. 14*s*. 4*d*.; October, £3,186. 2*s*. 5*d*.; leaving credit balance, £5,840. 19*s*. 2*d*. The profit on the two months' working was £2,800. 15*s*. 8*d*. A dividend, and bonus together £2,560 (£5 per share) were declared, and £3,280. 19*s*. 2*d*. carried to credit of next account. Captain Peter Clymo reported—"The new discovery alluded to in my last report has failed, the lode at present being unproductive, but still a very promising one, and I think we must go deeper before we have much ore. This level is called the 100, but it is not, in fact, so deep as the East Caradon 50-fm. level. The other parts of the mine are still looking very well, with every probability of a continuance."

At Craddock Moor Mine (Jan. 28), the accounts for September and October showed—Balance last audit, £1,584. 11*s*. 1*d*.; copper ores sold and carriage, £2,420. 1*s*. 4*d*.=£4,004. 12*s*. 5*d*.—Mine cost, merchants' bills, and sundries, £1,926. 17*s*. 9*d*.; November dividend, £369. 5*s*.: leaving credit balance, £1,708. 9*s*. 8*d*. The profit on the two months' working was £493. 3*s*. 7*d*. A dividend of £369. 5*s*. (7*s*. per share) was declared. Capts. H. and J. Taylor and Phillips reported on the points of operation. They estimate to sell 300 tons of usual quality copper ore in the next two months.

At East Wheal Basset (Jan. 28), the accounts showed—Balance last audit, £1,155. 19*s*. 2*d*.; ore sold, &c., £2,482. 2*s*.=£3,638. 1*s*. 2*d*.—Mine cost, merchants' bills, and sundries, £1,156. 16*s*. 4*d*.: leaving credit balance, £2,481. 4*s*. 10*d*. A dividend of £1,536 (£3 per share) was declared, and £945. 4*s*. 10*d*. carried to credit of next account.

At the Copper Hill Mine (Jan. 28), the accounts for the four months ending December showed—Ores sold (deducting £209. 12*s*. dues, at 1-16th), £3,144. 0*s*.5*d*.; sundries, £29. 4*s*. 4*d*.=£3,173. 4*s*. 9*d*.—Balance last audit, £403. 17*s*. 2*d*.; mine cost, merchants' bills and sundries, £2,013. 1*s*. 8*d*.: leaving credit balance,

£756. 5s. 11d. The profit on the four months' working was £1,160. 3s. 1d. A dividend of £512 (£2 per share) was declared, and £244. 5s. 11d. carried to credit of next account. Captains J. Davey and Son, Inch and Johns, reported upon the various points of operation.

At the SOUTH TOLGUS MINE (Jan. 28), the accounts for November and December showed—Balance from last audit, £68. 1s. 9d.; ore sold, £2,753, 10s. 9d.= £2,821. 12s. 6d.—Mine cost, merchants' bills and sundries, £2,267. 1s. 3d.: leaving credit balance, £554. 11s. 3d. The profit on the two months' working was £486. 9s. 6d. A dividend of £512 (£1 per share) was declared, and £42. 11s. 3d. carried to the credit of the next account.

At the MINERA MINING COMPANY meeting (Jan. 28), the directors declared a dividend of £3. 10s. per share, from the profits to last Christmas.

At the PEN-AN-DREA UNITED MINES (Jan 29—Mr. Robert Pulsford in the chair), the accounts showed—Credit balance last account, £1,546. 17s. 9d.; tin sold since last meeting, £2,955. 19s. 9d.; copper ore, £279. 3s. 9d.; arsenic, £55. 10s.; calls received, £1,721. 12s. 10d.=£6,559. 4s. 1d.—September, October and November labour cost, £3,178. 3s. 2d.; merchants' bills, &c., £2,199. 11s. 8d.; leaving balance in hand, £1,181. 9s. 3d.

At the CARN BREA MINING COMPANY (Jan. 31), the directors declared their 112th dividend of £2 per share—making the sum of £271. 10s. already paid on each £15 share.

At DOLCOATH MINE meeting (Feb. 3), the accounts for November and December showed—Balance last audit, £528. 4s.; by copper ores sold, £282. 4s.; tin ore, £11,011. 6s.; extra carriage of tin, £10. 10s. 7d. (less dues, £470. 11s. 3d.; and rates, £50.)=£11,311. 13s. 4d.—By tutwork and surface labour, £4,349.14s. 10d.; tribute, £970. 0s. 9d.; merchants' bills, £2,082. 18s. 10d.; making profit on the two months' working, £3,380. 14s. 4d. A dividend of £3,222 (£9 per share) was declared, and £686. 18s. 11d. carried to next account. The agent's report is among the Mining Correspondence.

At WHEAL BASSET (Feb. 4), the accounts for November and December showed—Balance last audit, £1,549. 2s. 8d.; ore sold and sundries, £4,880. 17s. 5d.= £6,430. 0s. 1d.—Mine cost, merchants' bills and sundries, £3.156. 9s. 3d.; leaving credit balance, £3,273. 10s. 10d. The profit on the two months' working was £1,724. 8s. 2d. A dividend of £1,536 (£3 per share) was declared, and £1,737. 10s. 10d. carried to the credit of next account.

At the WEST CARADON MINE (Feb. 5—Mr. Harris in the chair), the accounts for September and October showed a profit of £879. The balance of assets over liabilities was £5,374. A dividend of £1,024. (£1 per share) was declared, and a balance of £4,350 carried to the credit of the next account. Details in another column.

At DRAKE WALLS (Feb. 6), the accounts for the three months ending December showed—Balance last audit, £1,248. 4s. 2d.; tin ore sold, October, November and December. £4,289. 7s. 10d.; arsenic sold, £137. 10s. 10d.; account overcharged by Duchy of Cornwall, £1. 1s.=£5,676. 3s. 10d.—Mine cost, dues, &c., October, November and December, £3,874. 10s. 8d.; extra disbursements, £70. 3s. 11d.= £3,944. 14s. 7d.: leaving credit balance, £1,731. 9s. 3d.

At ST. IVES WHEAL ALLEN meeting (Feb. 5), the accounts showed a balance of only £389. 15s. against the mine at the end of December, 1861, and a call of 7s. 6d. per share was made. The 30, east of Giesler's shaft, is worth £18 to £20 per fathom, and they have had a good lode in this end for the last 12 fathoms; this level is also driven further east than any other below the adit, which looks well. The 10, east of Roderick's shaft, is worth £20 per fathom, and the shaft is about to be sunk to the 20, and a good lode is expected in sinking, The stopes and pitches have improved. They have sold 6 tons 7 cwts. 2 qrs. 20 lbs. of black tin, and in future regular sales will be made, while the costs will be much lighter than hitherto, all the surface work, &c., being complete. The agents state, "The mine is gradually improving, and we believe it will continue to do so."

At HERODSFOOT Mine (Feb. 4), the accounts showed a profit upon the four months' working to end of December of £2,167. 19s. 8d.; a cash balance of £1,443. 16s. 11d.; and a balance of assets over liabilities, of £3,145. 6s. 10d. A dividend of 35s. per share was declared. Messrs. Loam, Glubb, Caunter, Davy, Hawker and Medland were re-elected members of the committee. Captain T.Trevillion reported on the mine, which was in good working trim, never better at any former time. The qualities of the ores also we e never richer then during the last four months, as the

average price of the two 85-tons parcels realised £27. 16*s.* per ton; this is very satisfactory, especially when the reserves of orey ground in the mine are not in the least diminishing, but rather on the increase, and they look forward with confidence for regular and continued dividends.

At the Tincroft Mining Company (Feb. 7), the directors declared a dividend of 5*s.* per share.

At Charlotte United Mines (Feb. 6—Mr. Alexander in the chair), the accounts for the four months ending November showed—Balance last audit, £2,590. 12*s.* 2*d.*; August mine cost, merchants' bills, &c., £1,014. 9*s.* 4*d.*; September, £1,144. 5*s.* 8*d.*; October, £1,025. 18*s.* 8*d.*; November, £1,082. 1*s.* 9*d.*; Mr. Pike's lease, £26. 5*s.*=£6,883. 12*s.* 7*d*,—Call, £2,894. 13*s.* 9*d.*; copper ore sold £2,322. 0*s.* 3*d.*; tin, £25. 3*s.* 9*d.*, leaving debit balance, £1,641. 14*s.* 10*d.* The report of the agents, Captains R. Kendall and J. Penberthy, recommend an application to the lords to remit dues until the mines become more remunerative. A call of 5*s.* 6*d.* per share was made. It was resolved that a petition in the Stannaries Court be filed forthwith against all shareholders in arrear of call; that the operations recommended by the agents be carried out with vigour; and that an application be made to the lords for a suspension of the dues. The committee of management were re-elected.'

At Kelly Bray (Feb. 13—Mr. J. Field in the chair), the statement of accounts for the three months ending December showed—Balance last audit, £107. 4*s.* 1*d.*; call received, £486. 0*s.* 6*d.*; copper ore sold, £753. 3*s.* 5*d.*=£1,346. 8*s.*—October, mine cost, merchants' bills, &c., £429. 17*s.* 1*d.*; November, ditto, £419. 4*s.* 2*d.*; December, ditto, £425. 15*s.* 5*d.*; expenses and loss upon forged shares, £24. 3*s.* 1*d.*= £1,298. 19*s.* 9*d.*; leaving credit balance, £47. 8*s.* 3*d.*

At Wheal Trelawny (Feb. 8—Mr. W. Page in the chair), the following statement of accounts for the three months ending November, showing a profit of £1,265. 6*s.* 6*d.* (or 24*s.* per share), was submitted:—Silver lead ore sold, £6,271. 3*s.* 3*d.*; mine cost, £4,243. 7*s.* 8*d.*; merchants' bills, £1,288. 16*s.* 10*d.*; Royalty, £306. 0*s.* 9*d.*; interest, £39. 0*s.* 2*d.*; income tax, £128. 8*s.* 10*d.*; incidental expenses, 2*s.* 6*d.*=£5,005. 16*s.* 9*d.*; leaving credit balance, £1,265. 6*s.* 9*d.* The assets exceeded the liabilities by £2,106. 18*s.* 2*d.* A dividend of 15*s.* per share was declared, leaving a balance of £485 to be added to the reserve fund.

At the Clifford Amalgamated Mines (Feb. 19), the accounts for November and December showed—Ores sold, £14,273; balance last audit, £1,135; merchants' bills, £2,592; Redruth and Chacewater Railway, £278: on account of coals, £1,550; labour cost, £6,474; leaving credit balance, £2,240. A dividend of £1,862 (12*s.* 6*d.* per share) was declared, leaving credit balance, £378.

At Prosper United (held at the company's offices, Bishopsgate-street Within, Feb. 21, Mr. F. Hill in the chair), the accounts showed—Balance last audit, £7,885. 0*s.* 5*d.*; mine cost, Sept. to Dec., and subsist for Nov. to Feb. inclusive, £2,897. 7*s.* 3*d.*; merchants' bills four months ending Dec., £3,130. 7*s.* 11*d.*;= £13,912. 15*s.* 7*d.*; calls received, £5,906. 15*s.*; arrears received, £110; copper ore sold, £596. 4*s.* 2*d.*; tin sold, £415. 12*s.* 7*d.*=£7,028. 11*s.* 9*d.*; leaving debit balance, £6,884. 3*s.* 10*d.* A call of 23*s.* per share was made.

WALES.

At the Vigra and Clogau meeting, January 24, the sum of £100 was awarded to the directors for their services to the end of last year, and it was resolved that £5. 5*s.* should be allowed as attendance fees for each future board meeting; the sum of £50 was voted to Mr. Gillman for past services, and his future salary as secretary was fixed at £100 per annum; Mr. Goodman was awarded £20 for past services and advice, and his fee as auditor for the present year was fixed at £10. 10*s.* The shafts suggested by Captain Paull in 1860, and subsequently by Captain Pascoe, for facilitating the profitable working of the copper lodes, have, from serious impediments, been abandoned, and two deep adits, under the advice and to meet the views of the Government surveyor, have been opened, one at Vigra and the other at Clogau Mountain, and negotiations are pending for effecting these cuttings by machinery. During the past year only 25 or 30 tons of copper ore had been dressed, and, as it does not pay to raise the ore by the present mode, the prosecution of the same has been suspended. The gold is obtained from the St. David's lode, worked under a license from the Crown, distinct from Vigra and Clogau. Capt. John Parry reports that during the year 37½ fathoms of ground have been removed. The quantity of auriferous ore carted down from St. David's lode and

passed through the large machines was 449 tons 18 cwts., yielding 580 ozs. 10 dwts. 7 grs. of fine gold, and the visible gold that passed through the small machines was 6 tons 2 cwts. 32 lbs. yielding 2,303 ozs. 11 dwts. Capt. Pascoe thinks there is plenty of auriferous quartz above the level for the present machines for many years.

COLONIAL AND FOREIGN.

At the Scottish Australian Mining Company meeting (Mr. W. H. Dickson in the chair), it was stated that the company was established with the immediate object of purchasing eleven specific properties in New South Wales—one of which was known to contain copper and others coal—and of acquiring any other mineral properties, having great promise, that those entrusted with its management might from time to time have it in their power to secure in the Australasian colonies; and, having obtained them, either to work them, or, after more or less exploration, to dispose of them as may appear most beneficial to the company. That it was also confidently anticipated that the company, having a fruitful and constantly widening field to work in, would by degrees and in due time become a mining association of an extensive and important character, not only general in its objects but very successful in its results. That the procedure by which the directors desired to make a commencement to carry out the objects of the company was confined to the development of the copper mine in the Good Hope property, and to the establishment of a colliery near the port of Newcastle, perhaps the most rising town in the Australian colonies. The Chairman stated that the operations at Good Hope Mine during the past twelve months had been mainly directed to the sinking of the shaft below the 30-fathom level, and exploring to intersect the lode at that depth. The whole of the work had been economically conducted, and although a large amount of work had been done, the cost did not exceed £3,457. The most satisfactory results were anticipated from this property. With regard to the Cadiangullong Mine, which comprised an area of 564 acres, it was situated 14 miles from Orange, 40 from Bathurst, and 160 from Sydney. The terms upon which a 21 years' lease has been obtained were simply a royalty of 1-12th of the ore to be raised. A commencement of mining operations on the property was made at the end of July last, and though no machinery nor expensive appliances had been used, 600 tons of ore were brought to grass by the middle of November. Copper ore was found at 18 feet from the surface, where a lode was found 68 to 70 feet wide, and extending for at least half a mile in length. From all the data that could be collected relative to this property, there were abundant reasons for believing it would prove of great value, and become a permanently paying property. Of the 600 tons brought to grass in the short period above referred to, one-fourth yielded an average of 40 per cent. of copper, and the whole was estimated to average upwards of 20 per cent. The 600 tons was computed to be worth £12,000, while the cost of obtaining it did not exceed more than £2,000. The smelting works were probably completed by the present time. The company also had several coal properties, and the lease had been executed of 2,560 acres of coal producing land, situated near Newcastle. It had been fully proved to contain several seams of coal of the very best description. The lease of the Good Hope property was freehold. The Cadiangullong Mine was held upon a lease of 21 years, on a royalty of 1-12th; and the 2,560 acres of coal property was held upon a lease for 50 years. A Proprietor enquired if there was any truth in the rumour that five men in two days raised £400 worth of ore from the Cadiangullong Mine? The Chairman replied there had been a rumour to that effect, and he believed the rumour to be true. A Shareholder enquired as to the cost of carriage of ore or copper from Cadiangullong to Sydney? It was explained that it would not be comparatively heavy, as the roads in New South Wales (unlike the other Australian colonies) are excellent, having been made long ago by the labour of convicts. The road from Sydney to Bathurst was said to be as good as could well be desired. The report and accounts were then received and adopted, and the retiring directors and auditor reappointed. A special resolution was then unanimously passed, to the effect—That the capital of the company be, and hereby is, increased by the creation of 40,000 additional shareholders of £1 each, to be offered rateably, in the first instance, at par to all existing shareholders; and that the sum of 10*s*. per share shall be payable on all such additional shares on or before March 31st next; the holders of the additional shares

shall be entitled to participate in the profits and advantages of the company on precisely the same footing as the holders of the said 80,000 shares; in issuing the additional shares no fractional part of a share shall be allotted to any person, but all such fractional parts shall be offered for sale for the benefit of the company. A vote of thanks to the Chairman and directors terminated the proceedings.

Metal Markets.

THE character of the market during the month has been marked by extreme dulness. Very little business has been doing, even at reduced rates, and many second-hand parcels hang on hand notwithstanding the low rates at which they are offered. Shipments to America and the Continent are on the increase; and for the former there are many orders on hand, which, under present circumstances, shippers are unwilling to execute without cash.

IRON.—The market for railway bars has remained without alteration during the month, and no improvement can be expected until the rate of production, now so far in excess of the demand, is reduced. Merchant bars have been in good demand, but no advance has been possible, nor likely to be, as long as railway orders remain so scarce: price. £5. 2*s*. 6*d*. to £5. 5*s*. at the works; and £6, f. o. b. in London. For Staffordshire makes there has on the whole been rather more enquiry, and they seem to be recovering from their long-continued dulness; but there has been no alteration in prices. Swedish bars have been quiet, in fair request at quoted prices. Scotch pigs have slightly fluctuated during the month, having in the early part advanced about 1*s*., being quoted 49*s*. 3*d*. to 49*s*. 9*d*. mixed numbers; later on they declined from 49*s*. to 48*s*. 9*d*.

COPPER.—On the 3rd of the month, the smelters of English announced a decline in fixed rates of £5 per ton on raw, and ½*d*. per lb. on manufactured descriptions; making the official rates £102. 10*s*. for cake, tile and ingot, and 11½*d*. for sheet and sheathing. This reduction had been anticipated, for the fixed rates had been for some time nearly nominal. Indeed, in some quarters a greater drop was expected; for the selling prices are still much below the fixed rates, numerous orders, particularly for India, having been executed at 10¾*d*., or ¾*d*. under price. The continued fall in the standard necessarily depresses the market, and cake and tile can be purchased very much under fixed rates. Foreign has been dull, Burra Burra having changed hands at prices ranging from £98 to £97; Kapunda, £100 to £98; Chili, £90 to £88, and Spanish £88 to £90. Yellow metal was lowered, with copper, to 9½*d*. but is selling at 1*d*. under that rate.

TIN.—The demand for English has been quiet but steady, smelters adhering pretty closely to fixed rates. Foreign has been very dull, but has recently slightly rallied. Straits have ranged from £119 to £116; Banca, £124. 10*s*. to £123. During the month Tin plates have been in good demand, principally for shipment to America, to anticipate the expected increase in duty.

LEAD.—This metal has, on the whole, been firmer during the month. In the early part there was a slight tendency to an advance, but later it has been rather the other way. Still sellers are tolerably firm.

SPELTER.—The Spelter market has been quiet, and in the early part of the month sales were made at £18 to £18. 2*s*. 6*d*. This quotation, however, has scarcely been maintained, sales having been made as low as £17. 10*s*. Zinc steady through the month at £23. The following is from the last report of Messrs. Berger Brothers:—"Since our last nearly 800 to 900 tons

have been bought at £18 to £18. 2*s.* 6*d.* for parcels on the spot. Orders from India are still scarce, but as the shipments to that quarter have been so much below the average during the last twelve months, we look forward shortly for a brisk demand from there, and whilst prices on the Continent are above ours, we cannot expect a very great supply: hence our stock is likely to be steadily reduced, and prices firmly maintained, with prospects of improvement.

Stocks on Feb. 1, 1862	Tons 5,423	price from	£18	0	0	to	£18	2	6
„ „ 1861	 4,701	„	18	7	6	to	18	10	0
„ „ 1860	 3,742	„	21	0	0	to	21	5	0
„ „ 1859	 4,441	„	22	10	0	to	22	15	0
„ „ 1858	 2,204	„	27	0	0	to	27	5	0

Metallic-Ore Markets.

Tin.—The standards for black tin remain unaltered at,

Refined ... £111.
Common ... 107.

In a recent number, the *West Briton* states that "The demand for metal appears to be quite equal to the supply of Tin from the mines, but there appears no upward tendency."

Copper.—At the four Cornish sales we give this month, the average produce, price per ton, and standard, have been as follows:—

	Produce.	*Price per Ton.*	*Standard.*
Jan. 30	... 6¼	... £5 4 6	... £129 1 0
Feb. 6	... 5⅞	... 4 16 6	... 125 9 0
„ 13	... 6⅜	... 5 4 0	... 123 13 0
„ 20	... 5⅜	... 4 5 0	... 128 19 0

Thus, through the whole month, there has been a dropping standard. What the exact decline really has been is thus estimated by the *Mining Journal* and *West Briton*. At the sale of January 30th, the former makes the decline 20*s.*, and the latter 18*s.*; at that of Feb. 6, the *Journal* gives a decline of £2, and the *West Briton* one of £2. 2*s.*; at that of Feb. 13, the former makes the fall £2, and the latter only £1. 14*s.*; and at that of Feb. 20, the *Journal* estimates the decline at £2, while the *West Briton* only makes it £1. 2*s*. It will be remarked that the estimates of these two papers are much nearer than was the case in former months, which might lead one to believe, were it not for the experience of a long series of discrepancies, that really calculations on this subject are not so uncertain as we have stated them to be.

Lead.—Comparing the sales of Lead Ore for the month with those of the former month, there appears to be no material alteration in prices.

London Share-Market.

The amount of business transacted during the month may be characterised as fair, considering the almost inanimate condition of the metal market. The easy terms upon which money is negotiable has however given a degree of stability to the share markets, and the continued eagerness evinced by the public to invest in certain selected mines augurs favourably for the ensuing month.

The most important and recent discovery is that at Wheal Grenville, where the lode in the 80-fm. level is reported to be worth £50 per fm. for tin, whilst the copper lode in the 100-fm. level west is also showing indications of improvement, being worth at the moment £12 per fm. This mine has been working for a considerable period in comparative poverty; it will therefore be a source of great encouragement to the shareholders to find that at length it shows some signs of eventually rewarding their perseverance and patience. There have been many improvements expected during the last few months, and it is therefore confidently hoped that the above is only the precursor of many others so anxiously awaited.

The details of the operations in shares will be gathered from the following:—

Alfred Consols occasionally enquired for, but not many actual transactions; the nominal quotations are given as $\frac{1}{4}$-$\frac{1}{2}$, and the latest reports received from the mine are of a more cheering character than for some time past.

Condurrows have been frequently dealt in, and were quoted as high as 77$\frac{1}{2}$-80, but are at present rather easier.

Carn Brea attract a little attention, and close 70-72$\frac{1}{2}$.

Cook's Kitchen shares have been gradually absorbed for investment for some weeks past; they are now very scarce even at advanced prices, and the mine is reported to be looking most favourable.

Clifford Amalgamated have been very fair at 30-32. At the meeting a dividend of 12*s.* 6*d.* per share was declared, and a credit balance of £378 carried forward.

Camborne Vean more in request at 2$\frac{1}{8}$-$\frac{3}{8}$.

Carn Camborne has remained very steady at 11 to 13, with a fair enquiry.

Craddock Moor very scarce, only one or two shares having changed hands: the price is firm at 27-9. Devon Great Consols have been much sought after, but holders do not seem inclined to part with their shares, as the many orders to buy have been returned unexecuted: they close 410-20. East Basset continues dull in character, at lower prices—47$\frac{1}{2}$-50. East Caradon, after touching 31, receded again to 30$\frac{1}{2}$-$\frac{3}{4}$, at which they close. A large amount of business has been done in these shares at various prices between 30 and 31: the latest reports from the agents give the valuations of the ends as follows:—The 50 east, £80 per fm.; 60 east, £50; Fawcett's lode, £15; new lode, £8; 60 west worth £40 per fm.

East Carn Brea remain tolerably steady at 10$\frac{5}{8}$-$\frac{7}{8}$: the mine is looking promising for further improvement, and the next sampling is expected to be 350 tons. East Grenville, after declining to 25*s.* sellers, improved to 30*s.*-32*s.* 6*d.* East Russell firmer at 3$\frac{1}{4}$. East Devon Consols steady at 1$\frac{3}{4}$-2. Great Fortune have been largely dealt in, and close very firm at 15$\frac{1}{2}$-16. Great Wheal Vor many buyers but no sellers at present prices, 6$\frac{1}{2}$-7. Great South Tolgus have been in demand and close lower.

In Herodsfoot only a moderate amount of business transacted, the price advanced to 38-40, but they close rather lower—35$\frac{1}{2}$-36$\frac{1}{2}$ ex div. The dividend declared at the meeting was 35*s.* per share, and the agent gave a very favourable report on the prospects of the

stating that it was never looking better than at present. on Down shares have been very flat for some time past, with r any business doing: at the meeting the accounts showed a alance of £145. 2*s.* 4*d.* Marke Valley remained very firm ady at 10⅛-⅜; the mine continues to look well, and the sam- are kept up without intrenching on the reserves. New Seton iderable request, and advanced to 65-70; they close a trifle . North Downs declined to 5-¼; there have been numerous s in these shares throughout the month, but there has been a lerance of sellers. North Roberts advanced to 25*s.* "buyers," bsequently declined to 20*s.*-22*s.*, at which they close. North rather more enquired for at 3-½. North Treskerby have ed a good deal, and close weak, 21-22. North Crofty 2-2¼ and d for. Noth Roskear 22-23, with a good busines doing. Consols, after being dealt in at 9, close 8-8½, owing to sellers g the shares on the market. In Providence shares, there has moderate amount of business done during the month; the as become lower towards the close, being 41-43. Prosper nominally 2¾-3¼, a call of £1. 3*s.* was made at the meeting. ll Hill and Ransom close 4⅝-⅞, and have been largely dealt in; West is expected to improve in a short time. South Tolgus nally sought after. South Caradon are quiet but firm at 22½, with only a limited number of transactions. South s weak in character, caused principally by the protracted ry dispute with the West Basset adventurers: the quotations ent are 97½-102½. St. Ives Consols still drooping; they close Stray Park very steady at 30-31. roft greatly in request, and shares very scarce: the price has ed to 9¼-¾. Treloweth remain steady at 25*s.* to 30*s.* without enquiry. Tamar silver lead, very dull at present; nominally 1½-¾. Wendron Consols have been in great request, and ad- to 13-14. West Caradon weak at 39-41. West Frances a nquired for at 9-11. West Rose Down are eagerly picked up estors. The prospects of this mine are very encouraging, as the ljoins Marke Valley; the shares are now 15-16. West Pol- ave declined to 2s. 6*d.* to 4*s.*; the next lode will, it is expected, ersected in about the space of another week. West Seton a shade firmer, the mine looking better. Wheal Arthur 14*s.* 6*d.*, *l.*: the lode in the 50 fm. level is worth two tons of copper r fm. Wheal Grylls have advanced to 15-1; the supply of

than they have been, viz., 17-18; a dividend of 15*s*. per share was declared at the meeting, and a credit balance of £1,320 carried forward. West Basset, very steady, 13-14. Wheal Unity have been in request, and close 19*s*-21*s*.

In Welsh mines there has been a good business done, although the deplorable accident at Bryn Gwiog has cast a sad gloom over this district. At Billins, the lode in the level driving west is worth one ton per fm., and improving; the shares are 17-18. Lonkrake rather quiet; at the meeting a call of £1 per share was made. North Minera, 17-19, with some few enquiries; at the meeting of the Minera Company, a dividend of £3. 10*s*. per share was declared. Mount Pleasant lead mine divided £1 per share, at the meeting of the Company, held at Chester.

In foreign mines there has been an average amount of business done in the Stock Exchange. St. John del Reys have fluctuated between 63 and 67, and many transactions have taken place; they close 63-5. United Mexican remain tolerably steady at present at 8½-¾, but at one time during the month were marked as high as 9¼. Great Northern Copper have declined, and close 1-¼; a call of 5*s*. per share was announced. East del Rey steady at 1½-¾. Port Philip 1-¼, with frequent dealings. Scottish Australian have been in considerable request, and close at an advance 2⅛-⅜. North Rhine rather improved owing to better reports from the mine. Maraquita have been dealt in at ⅞. Dun Mountain, firm at 1-⅛. General Mines steady, 23-24, ex. dividend. Worthing, not much doing, ½ to ⅝. Bon Accord very dull at ¼-½. Fortuna, 2-2½. Jus Cobre Copper, Linares, Kapunda, Brazilian, Lusitanian and Pontgsiband very little business doing, and scarcely any variation in prices.

Friday, 28th February, 1862. 2.30 P.M.

The following are the closing prices:—

Not much doing besides settling the account. East Caradon remain steady; East Carn Brea very strong at an advance. A good business doing in Wheal Grenville and East Grenville. Sellers of Buller and Clifford. Wendrons rather weaker.

Camborne Vean, 1½ to 2; Carn Camborne, 13/. to 15/.; Cook's Kitchen, 30¾ to 1; Devon Great Consols, 410 to 20; East Basset, 47½ to 50; East Caradon, 30⅝ to ⅞; East Carn Brea, 11 to ¼; East Grenville, 32/6 to 35/.; Great Wheal Fortune, 15½ to 16; Great Wheal Vor, 6½ to 7; Herodsfoot, 35 to 36; Marke Valley, 10⅛ to ¼; North Downs, 5 to ¼; North Robert, 18 to 20; North Treskerby, 20 to 21; Providence Mines, 41 to 42; South Caradon, 317½ to 22½; Stray Park, 30 to 31; Tincroft, 9⅞ to ⅝; Wendron Consols, 13 to ½; West Caradon, 40 to 1; West Rose Down, 15½ to 16; West Seton, 275 to 80; Wheal Buller, 65 to 70; Wheal Clifford, 30½ to 1½; Wheal Grenville, 2⅞ to 3⅛; Wheal Ludcott, 2⅞ to 3⅛; Wheal Margaret, 43 to 4; Wheal Mary Ann, 15½ to 16; Wheal Seton, 121 to 3; Wheal Uny, 5⅛ to ⅜.

Provincial Share Markets.

Dublin.—The following report is condensed from the *Mining Journal*;—Towards the end of January the market was rather active, and prices experienced frequent fluctuations, exclusively regulated by supply and demand. Wicklow Copper Mining Company shares rose from £54. 7*s.* 6*d.* to £55, and again receded to £54. 5*s.* Mining Company of Ireland shares were more steady, and in request at £16. 5*s.*, ex. div. General Mining Company for Ireland shares offered at £5. 7*s.* 6*d.*, and takers at £5. 5*s.* Connorree shares on sale, and weak at 31*s.* 6*d.* Carysfort shares at 7*s.* 6*d.*, or a reduction of 6*d.* in the price last reported.

Early in February the shares of the Mining Company of Ireland steadily advanced from £16. 5*s.* to £16. 15*s.* for cash, and £16. 17*s.* 6*d.* for account, in great request. Wicklow Copper Shares sold at £54. 5*s.*, but recovered to £54. 10*s.*, in fair demand. General Mining Company for Ireland shares on sale at £5. 5*s.* Carysfort shares 7*s.* 6*d.* Connorree shares nominally quoted at 31*s.* to 32*s.* 6*d.* sellers. The preference shown for the shares of the Mining Company of Ireland over those of the Wicklow Copper Mining Company is in a great measure attributable to the more convenient subdivision of the capital of the former into 20,000 shares, while that of the latter is divided into 5,000 only—thus rendering them much heavier, and placing them at a great disadvantage in juxtaposition with those of the Mining Company of Ireland, which is strikingly demonstrated by the present prices. With about equal prospects and public favour, the Mining Company of Ireland shares now command in round figures £17 per 20,000th part, giving a market value to that stock of £340,000, while those of the Wicklow Copper Mining Company, at the present average price of, say, £55 per 5,000th part, give only £275,000 as the total value of their mines, and a difference in favour of the property of the Mining Company of Ireland of £65,000.

Later in the month the Mining Company of Ireland shares rapidly rose as high as £18, but suddenly dropped to £17¼, again rallying, however, to £17. 10*s.* Wicklow Copper Mining Company weak, at £54, or a fall of 10*s.* General Mining for Ireland nominally £5. Carysfort shares taken at 7*s.* 6*d.*, sellers at 8*s.* After the publication of the accounts of the Connorree Mining Company for the six months preceding November 30th last, the shares fell to 28*s.* and 29*s.*, sellers, being a fall of 3*s.* 6*d.* to 4*s.* per share. The accounts alluded to show that out of the proceeds of 40,000 shares at 20*s.*, or £40,000, there has been expended to November, 1860—for the mine, expenses of promotion and new work, £26,232. 5*s.* 6*d.*; and for "new work" to May 31, 1861, £3,748. 15*s.* 2*d.*; and to November 30, 1861, £2,778. 3*s.* 2*d.*; leaving a balance on November 30, 1861, of £7,290 16*s.* 2*d.* Of this has been further expended £3,361. 16*s.* 2*d.* for "mining" expenses to November 30, 1861, without explaining the difference between "new works" and "mining expenses;" and £836. 5*s.* 8*d.* for directors, auditors, and office expenses in Dublin and London for the 12 months ending November 30th last, &c.

Still later in the month business was active, but prices of shares in the two dividend-paying mines—the Mining Company of Ireland and the Wicklow Copper Company—not been well sustained; the former fluctuated from £17. 15*s.* to £17. 7*s.* 6*d.*, at which they were in request. The demand for Wicklow Copper Mining Company shares was considerable, but sellers numerous enough to bring down the price to £53. 10*s.*, being a reduction of 10*s.*; this has been caused chiefly by a feeling of uncertainty as to the resolution the shareholders may come to at the extraordinary general meeting called for Tuesday next, and as to the view leading capitalists may take of the extent of the benefit to be conferred on the Wicklow Copper Mining Company by the proposed amalgamation with the ancient Hibernian Mine Company. The latter was founded in 1780, and soon after incorpo-

rated by Act of Parliament for the purpose of working Ballymurtagh Mine, Ovoca, Co. Wicklow, and for other objects. These mines in the course of many vicissitudes to which valuable mining properties are often subjected before they acquire permanent success, passed through the hands of Mr. Henry Hodgson to the present Wicklow Copper Mining Company, the principal and oldest shareholders of which are also shareholders in the Hibernian Mine Company, and, therefore, lessors to themselves. This same old company has also certain vested rights in the Arklow Harbour, and in a once contemplated canal on the course of the River Ovoca. Any arrangement which will effect, on fair and equitable terms, a complete amalgamation of these two companies, must save much profitless trouble and attendant expenses, and at any rate for that reason, if for no other, be beneficial to so extensive and important a concern as the Wicklow Copper Mining Company.

Carysfort shares have been largely taken at 9*s.* 6*d.*, at which they are still procurable, and the owners of Connorree shares hold on for 30*s.* General Mining Company for Ireland shares a shade better, some having been bought at £5. 2*s.* 6*d.*, at which price they offered.

MINING REVIEWS.

The Eleventh Annual Statistics of the Mining Interest. By WILLIAM HENRY CUELL, Esq. London: published at the Mining Journal Office; and by Messrs. Watson & Cuell, St. Michael's Alley, Cornhill. Price Sixpence.

LAST month we noticed Mr. J. Y. Watson's Review of the Progress of Mining during the last year. To Mr. Watson's Review Mr. Cuell's tabular Statistics form a valuable companion. They comprise the Dividend Mines of Cornwall, with the Welsh Mines in Messrs. Taylor's Office, and one or two others known in the "market."

Among the Cornish Dividend Mines, Mr. Cuell enumerates 46, which have divided an aggregate amount of £260,906. At the head of these stands Devon Consols, which divided £43,000; followed by Phœnix, giving £21,000; West Seton, £20,800; Dolcoath, £16,826; South Caradon, £15,360; and Wheal Clifford, £14,500. Among the Welsh Mines, Minera heads the list, having divided £27,450.

Besides the number of shares and dividends, Mr. Cuell's tables give the following particulars:—the metals produced by each mine, the parish in which it is situated, the name of purser, or secretary, and the address of the office, the system on which the partnership is conducted, the intervals of the meetings, the total metallic produce in tons of ore and money value, and the dates of the leases and the dues. That such a mass of information, compressed into the small compass of a single table, is most valuable to any one interested in mining affairs, is evident. The collection of it must have involved a great amount of labour; and the arrangement shows that Mr. Cuell is eminently a statistician.

EXTRACTS FROM MINING CIRCULARS.

From MR. EDWARD COOKE, 5, *Hercules Passage, London.*

THE new year commenced with an active market for British Mines. Subsequently a slight reaction has taken place, owing no doubt to the decline in the standard for copper ore, and the comparative dulness in the metal market generally, consequent upon the unhappy state of political matters in America, whereby we lose one of our best customers for metals. While there have not been any very startling discoveries lately, improvements in several progressive mines have taken place, thereby causing a better demand for this class of property. If we may judge by the numerous concerns styled "Mining Companies" that have been brought out lately, it may be inferred that speculation is rife just now. I fear, however, that like many previous ephemeral schemes they have been brought out by dint of reports, &c., that are not borne out by facts; hence nothing

but disappointment and loss is likely to attend those who embark their capital in them. There are many well-managed and established progressive mines that offer sufficient scope for the operations of those disposed to speculate in this class of property. With a proper regard to the district in which a mine is situated, and the respectability of its management, *chances* of large profits on an outlay may be frequently witnessed. I may instance East Caradon, Wheal Grylls, East Carn Brea, Tincroft, Devon Great Consols, Cook's Kitchen, Herodsfoot, and many other mines that have risen in price to an enormous extent during the past few months. There are others that will in all probability have a similar rise in price during the present year.

By making a proper selection, investments in British Mines can be made highly lucrative. Success may not immediately follow, but if a good district be chosen to operate in, and patience be exercised, the chances are greatly in favour of success: witness the Gwennap and Redruth districts. A great deal of patience was observed by the parties who worked Wheal Clifford, Great Consols, Wheal Buller, Wheal Basset, Dolcoath, &c.; but they reaped their reward in due time, and realized large fortunes by the interest they held in these respective mines, and are now counted among the wealthiest families in Cornwall. There are yet mines in the Gwennap and Caradon districts to be developed, that I confidently look forward to produce similar results to those I have named. The latter is comparatively a young district, although at present possessing some of the richest mines in Cornwall, and several progressive mines that only require time for development to become equally productive. As the spring advances we may hope for more activity in commercial matters generally, and Mining will not be the last branch of our home industry that will feel the beneficial effects of a revival in trade.

From MESSRS. WATSON and CAELL, 1, *St, Michael's Alley, Cornhill.*

Several speculative mines are getting into favour, and a large business has been done in them at advanced prices. Among them are the mines we have so often called particular attention to, from points we know must come off, sooner or later, though long deferred. Grenvilles, it will be seen, have had a great rise, but not yet to half their value, considering the discovery and the splendid situation of the mine. East Grenvilles, also, must take a good turn soon, as they will commence sinking the shaft below the 45 on the same lode, worth £60 per fathom at the 80 level in Grenville. Unitys have advanced to 20/. and will go to £2 if the lode is cut as good at the 75 as it is at the 50. South Caradon Wheal Hoopers in good demand. Bottle Hills in demand. Redmoors, after being depressed, are improving, Devon Consols, 410 415—business done. East Caradons firm. Marke Valleys in demand—a large business done, Hingston Downs improving. East Setons in request, at ⅜ 10/.

From MR. P. WATSON'S *Mining Circular, No.* 205.

The Mining Share Markets have during the past three or four weeks shown a gradual decrease in transactions, both for dividend and progressive shares; the depreciation or variation in prices, however, is scarcely perceptible, and the market on the whole may be characterised as almost at a standstill, yet somewhat firm, owing, no doubt, to the public, as investors, being reluctant to operate at present, seeing week after week the very serious fall in the standard for copper ores at the Cornwall and Swansea ticketings, which is now at a lower figure than for the last eight or nine years. The reduced price of tin also has had a depressing influence.

A reference to the Board of Trade Returns published last week, for the last twelve months, will show the very serious diminished exports of copper, tin and lead; this is owing mostly to the Secession movement in America; followed by actual hostilities on a gigantic scale,—and not forgetting, likewise, the obnoxious American tariff, which has had a very prejudicial

effect in this country. It is now generally believed, however, that in t price of copper and tin more especially, we have seen the worst, and we m therefore look forward to a favourable reaction, which will be exceedin cheering to investors in mines,—for on the *up and down* movement of t metal market, from many years' experience, we find that the mining sha markets are generally very sensitive to follow in the wake.

Considerable support has been given of late to prices of nearly every cl of investments, through the accumulation and cheapness of money, excep ing Cornish and Devon mining, and it would appear that the public have n yet paid that attention to this class of legitimate and profitable investme which it certainly deserves. Without going into detail to show the *millio sterling* given in profits to shareholders, we will content ourselves by nami the fact to the investing public, that there are at the present time ma mines now paying 15 to 20 per cent. per annum on the present mark price of shares, with every probability of an increase, whilst those of a pr gressive character are yielding considerable returns of ores,—many of whi are on the eve of a dividend state, and a considerable advance in mark value is fully anticipated.

BOARD OF TRADE RETURNS.

The returns for the month and twelve months ending December 31st, 18 were issued by the Board of Trade on Saturday last. We give a stateme of the total declared value of exports of British and Irish produce a manufactures during the month and twelve months in the last three yea

	For the Month.	For Twelve Months.
1859	£10,827,242	£130,411,529
1860	12,128,541	135,891,227
1861	9,760,129	125,115,133

For the month the exports were less by £2,368,412, or 19 per cent. than the same month of last year, and less by £1,067,113, or about 10 per cen than in December, 1859. The figures for the twelve months show a d crease of £10,776,094, or about 8 per cent., compared with 1860, and decrease of £5,296,394, or about 4 per cent. as compared with 1859,

In examining the exports of copper, tin, lead, and iron in the differe forms, we arrive at the subjoined general figures for the month :—

Month of December.	1859.	1860.	1861.
Copper—unwrought	£35,977	£72,947	£28,858
sheets and nails	178,498	143,467	129,339
Tin—unwrought	44,478	29,223	19,777
tin plates	64,543	98,499	89,767
Lead	31,608	52,071	25,189
Iron—in pig, bar, bolt, rod, railway, &c.	330,835	428,371	311,252
Ditto — steel—unwrought	67,225	102,528	71,309

From the above figures a mere glance will show that as compared with 186 the ratio of decrease in the month was much larger than the ratio decrease on the whole year.

The exports of all articles to the United States for the last quarter 1861, and for the whole year, gives as follows :—

	1859.	1860.	1861.
Quarter ending December 31st.	£5,046,183	£5,253,486	£2,167,218
For the whole year.	£22,116,372	£21,072,659	£8,639,971

The absolute net decrease in this branch of our American trade, as co pared with 1860, was therefore £12,432,688 ; and we will here only rema that this sum pretty nearly corresponds with the amount of the deficien in the year's exports to all parts, thus proving the dulness experienced our export trade during the last year was almost wholly occasioned by t unfortunate affairs and condition of America.

Prices Current of Metals.

		Per Ton.		
ON	Bars in Wales...	£5 2 6	@	£5 5 0
	„ „ Liverpool	......		5 15 0
	„ „ London..	6 0 0	„	6 5 0
	Nail Rods „ Wales ...	5 12 6	„	5 15 0
	„ „ Liverpool	6 10 0	„	7 5 0
	„ „ London..	7 5 0	„	7 15 0
	Hoops (Staffordshire) „ Liverpool	7 15 0	„	8 10 0
	„ „ „ London..	8 5 0	„	8 15 0
	Sheets „ „ Liverpool	8 10 0	„	9 5 0
	„ „ „ London..	9 0 0	„	9 15 0
	Bars „ „ Liverpool	7 0 0	„	8 0 0
	„ „ „ London..	7 10 0	„	8 10 0
	Scotch Pig (No.1.g.m.b.) the Clyde	2 8 6	„	2 9 0
	Rails in Wales.	5 0 0	„	5 5 0
	Russian C.C.N.D	......	„	......
	Swedish—Hammered—large sizes .	11 10 0	„	11 15 0
	„ „ Indian sizes	11 10 0	„	11 15 0
EL	Hammered—faggot	......		16 10 0
	„ in kegs ½ and ⅝ in. ...	......		15 10 0
ER	Australian and other *fine* Foreign..	96 0 0	„	97 0 0
	Foreign Slab, for Prod. 96 per Cent.	......	„	88 0 0
	English Tile and Tough	95 0 0	„	102 10 0
	„ Best selected	98 0 0	„	105 10 0
		Per lb.		
	„ Sheets, Sheathing and Rod	10½*d.*	„	11½*d.*
	„ Flat Bottoms	11*d.*	„	12*d.*
LOW METAL	Sheets, Sheathing and Rod	8½*d.*	„	9½*d.*
		Per Cwt.		
English	Common Blocks and Ingots	......		120*s.*
	„ Bars (in barrels)	......		121*s.*
	Refined	......		122*s.*
Foreign	Straits	117*s.*	„	118*s.*
	Banca	......		125*s.*
		Per Box.		
PLATES	Charcoal IC	28*s.*	„	29*s.*
t Liverpool	„ IX	34*s.*	„	35*s.*
6d. Less.	Coke IC	22*s.*6*d.*	„	23*s.*
	„ IX	28*s.*6*d.*	„	29*s.*
		Per Ton.		
)	Sheet	21 0 0	„	21 5 0
	Pig—W.B.			21 5 0
	„ ordinary brands	20 5 0	„	20 10 0
	„ Foreign, soft	......	„	19 10 0
	Red	......		22 0 0
	Shot	......		23 0 0
	Dry White	......		27 0 0
TER	(Cake)	£17 15 0	„	18 0 0
	(Sheet)	......	„	23 0 0
		Per Bottle.		
KSILVER	...(in bottles containing 75 lbs. each)	......		7 0 0
		Per Ton.		
JLUS OF ANTIMONY	French Star	......		47 0 0

metal market continues in a depressed condition, and a few forced sales have still r lowered the value of some of the leading articles.

N.—*Scotch Pig* remains steady, and with scarcely any change in price.

PER.—Quotations for *Foreign* are again lower, and the demand is small. *English* is e easier, sales of second-hand parcels being reported at 10½d. per lb.

—Not so much enquiry, and a few lots of very *fine Straits* have been sold at 117s. to ash; mixed lots fetching 116s. to 116s. 6d.

LTER.—No transactions, and the nominal prices are a trifle easier.

Copper Ores,

Sampled Jan. 15, and sold at Tabb's Hotel, Redruth, Jan. 30.

Mines.	Tons.	Purchasers.	Price. £	s.	d.
Great Wheal Busy	95	14	£1	17	0
	86	14	3	0	6
	66	9	2	15	6
	65	2	1	10	0
	64	9	2	15	6
	61	7	1	16	6
	58	14	2	16	6
	51	9	2	10	6
	43	9	3	10	6
	40	9	2	15	6
	36	3	6	5	0
	35	3	4	2	0
West Caradon	82	8	9	15	6
	76	11	6	12	6
	75	8	6	7	0
	73	10	5	12	0
	68	8	9	8	6
	55	8	8	14	0
	53	8	7	2	0
	35	2	1	15	0
Clifford Amalgamated (United Mines)	92	7	4	17	0
	91	14	2	15	6
	43	11	0	13	0
	42	11	2	7	0
	41	8	4	1	6
	40	6	2	19	0
	38	11	0	17	6
	35	11	1	11	0
	32	9	0	10	6
	28	3,8	3	19	0
	18	8	3	9	6
South Caradon	88	5,7	9	16	6
	73	7	9	7	6
	64	3	6	3	6
	51	2,3,7	15	2	0
	50	2,3,7	18	10	6
	48	4	6	6	0
	40	4	7	3	0
Fowey Consols	80	6	6	8	6
	79	7	9	12	6
	78	2,6	5	16	0
	75	7	6	7	0
	48	7	6	12	0
North Treskerby	80	4,8	3	19	6
	69	4	3	12	0
North Treskerby	60	4,11	£3	10	0
	49	4	9	13	0
	44	8	2	13	6
Tywarnhaile	59	2,8	1	19	6
	50	7,8	2	9	6
	43	3,5,7,8	2	17	6
	42	5,7	2	17	6
	38	9	4	12	0
	37	8	1	19	0
	32	4	7	13	0
North Downs	71	4	7	6	6
	62	7	7	15	6
	61	3	10	1	0
	56	3	7	8	0
Wheal Polmear	76	9	2	14	6
	51	11	4	2	6
	48	11	4	14	6
	45	6	7	19	0
Craddock Moor	64	2	7	10	6
	63	3	7	3	6
	50	7	6	8	6
	20	2	4	0	6
St. Day United	53	6	3	13	0
	46	6	5	13	0
	35	14	2	4	6
	30	11	1	18	6
East Crinnis	75	10	5	8	6
	62	3,7,10	4	8	0
South Crinnis	50	6	4	9	6
	45	7	4	16	6
Wheale Moyle	60	2,6	1	10	6
	8	8	5	18	0
Perran Mines	31	11	3	1	6
	26	11	3	9	0
Burra Burra	23	4	3	7	6
	16	8	1	15	0
	9	4	4	14	0
Gonamena	23	3	6	8	6
	8	9	3	19	6
Duchy and Peru	14	2,6	1	11	6
East Charlotte	14	14	2	1	6
Hender's Ore	7	6	1	18	0
Mines Royal Company	5	4	4	14	0
Wheal Cupid	3	8	10	10	0

TOTAL PRODUCE AND VALUE.

	Tons.	Amount. £.	s.	d.
Great Wheal Busy	700	1,929	3	6
West Caradon	517	3,747	1	0
Clifford Amalgamated	500	1,357	18	0
South Caradon	414	4,228	18	6
Fowey Consols	360	2,519	16	6
North Treskerby	302	1,366	19	0
Tywarnhaile	301	974	16	0
North Downs	250	2,029	11	6
Wheal Polmear	220	1,002	0	6
Craddock Moor	197	1,335	7	6
St. Day United	104	588	19	6
E. Crinnis and S. Par	137	679	13	6
South Crinnis	95	440	17	6
Wheal Moyle	68	138	14	0
Perran Mines	57	185	0	6
Burra Burra	48	147	18	6
Gonamena	31	179	11	6
Duchy and Peru	14	22	1	0
East Wh. Charlotte	14	29	1	0
Hender's Ore	7	13	6	0
Mines Royal Company	5	23	10	0
Wheal Cupid	3	33	8	0

EACH COMPANY'S PURCHASE.

	Tons.	Amount. £	s.	d.
2 Vivian and Sons	323 3¼	£1627	10	9
3 Freeman and Co.	417 1½	3133	10	9
4 Grenfell and Sons	416	2480	7	0
5 Crown Copper Co.	75¾	523	11	8
6 Sims, Willyams & Co.	397	1963	2	6
7 Williams, Foster & Co.	740 1¾	5057	11	10
8 Mason and Elkington	619¼	3665	18	4
9 F. Bankart and Sons	418	1182	12	0
10 Copper Miners' Co.	168¾	906	12	3
11 Charles Lambert	450	1503	12	0
12 Newton, Keates & Co.	—	—		
13 Alkali Co	—	—		
14 Sweetland & Co.	379	959	4	0
	4404	£23,003	13	0

Average Produce, 6¼
Quantity of Fine Copper, 272 tons 1 cwt.

Average Standard ... £129 1 0
Average Price per ton £5 4 6

Copper Ores,

Sampled Jan. 22, and sold at Tabb's Hotel, Redruth, Feb. 6.

Mines.	Tons.	Purchasers.	Price.		
Clifford Amalgamated	111	6	£6	4	0
(Wheal Clifford)	103	2,7	5	6	6
	101	5,7	4	6	6
	100	3	5	1	0
	83	7	4	16	6
	62	4	7	11	0
	60	3	6	6	0
	58	5,7	5	9	0
	57	3	4	8	0
	48	4,7	7	8	6
	34	4	2	6	6
	22	2	4	3	6
	21	6	14	8	0
	20	2,6	4	5	6
(Consols)	56	5,7	7	5	6
Wes: Seton..................	89	4,8	8	16	6
	88	4	7	7	0
	79	8	4	7	0
	71	7,10	6	4	6
	69	8	4	10	0
(Basset)	64	10	2	6	6
	59	4	7	5	0
	49	10	2	6	6
	45	8	5	2	6
Tincroft	118	2,6	0	15	0
	69	2	2	12	6
	54	10	2	10	6
	51	2	4	7	6
	49	14	2	8	0
	37	14	4	9	6
	25	10	8	11	0
	20	14	1	16	0
Wheal Basset	86	2,6	7	3	6
	80	5,7	5	16	6
	78	2	5	5	6
	70	8	10	8	0
	20	10	2	8	6
Wheal Seton	30	5,7,8	4	17	6
	8	5,7	1	7	6
(Pendarves)	81	5,7	4	11	6
	72	8,11	1	3	6
	55	2,6	0	2	6

Mines.	Tons.	Purchasers.	Price.		
Whl. Seton (Pendarves)	53	7	£5	8	6
	20	3	2	12	0
	12	2	13	6	6
	126	3,8	2	6	6
	71	8	1	16	0
	57	8	6	12	0
	54	5,7	5	10	6
	19	14	2	14	6
	61	8	3	5	6
	51	6	4	6	6
	50	11	0	8	6
	43	3	4	14	6
	42	8	2	15	6
	41	6,11	3	11	6
South Frances	85	3,6	4	5	6
	67	12	6	10	0
	53	2,6	9	5	6
	21	11	4	0	6
	5	14	4	16	6
South Tolgus	93	5,7	8	13	6
	82	8	4	2	6
East Basset	57	4,6	4	17	0
	55	6	6	1	0
	28	4	9	17	0
Camborne Vean	68	5,7	4	15	6
	53	4	3	9	0
Dolcoath..........	47	10	4	3	0
	45	10	3	3	0
Stray Park..................	46	6	3	4	6
	23	5,7	10	7	6
South Crofty...............	29	3	1	7	0
	19	12	6	8	0
	14	10	3	14	0
West Tolgus	52	2,6,10	4	11	6
South Basset	50	11	2	8	6
Wheal Grenville	22	2,6	5	6	6
	15	2,6	11	2	0
Carn Camborne	15	14	7	2	6
	13	8	2	17	0
East Grenville	23	6	3	10	0
Wheal Trefusis............	7	12	5	8	0
	3	10	4	12	0

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.		
Clifford Amalgamated	936	£5,314	11	6
West Wheal Seton	613	3,449	9	0
Tincroft	423	1,162	0	6
Wheal Basset	334	2,271	0	0
Wheal Seton.....................	331	1,118	14	6
Condurrow	327	1,147	1	6
East Pool	288	907	18	0
South Frances..................	231	1,399	2	0
South Tolgus	175	1,145	0	6
East Basset	140	885	0	0
Camborne Vean	121	£ 507	11	0
Dolcoath	92	336	16	0
Stray Park	69	386	19	6
South Crofty	62	212	11	0
West Tolgus......................	52	237	18	0
South Wheal Basset	50	121	5	0
Wheal Grenville	37	283	13	0
Carn Camborne	28	143	18	6
East Wh. Grenville	23	80	10	0
Wheal Trefusis...	10	51	12	0

EACH COMPANY'S PURCHASE.

		Tons.		£	s.	d.
1	Mines Royal Co..............	—		—		
2	Vivian and Sons.......	327	17½	2,389	5	0
3	Freeman and Co..........	372		1,574	12	0
4	Pascoe Grenfell & Sons	387		2,710	8	9
5	Crown Copper Co......	321		1,886	18	6
6	Sims, Willyams & Co..	600½		3,031	17	0
7	Williams, Foster & Co.	568		3,248	7	0
8	Mason and Elkington	742½		3,438	12	9
9	F. Baukart & Sons.....	—		—		
10	Copper Miners' Co......	873	17½	1,364	0	3
11	Charles Lambert	177½		342	12	3
12	Newton, Keates & Co.	93		594	18	0
13	Alkali Co..................	—		—		
14	Sweetland and Co. ...	179		581	0	0
	Total	4342		£21,162	11	6

Average produce, 5¾.
Quantity of fine Copper, 256 tons 12 cwt.

Average standard, £125 9s. 0d.
Average price per ton, £4 16s. 6d.

Copper Ores,

Sampled Jan. 29, and sold at Tabb's Hotel, Redruth, Feb. 13.

Mines.	Tons.	Purchasers.	Price.
Great Wheal Alfred	86	8, 11	£2 0 6
	78	8	3 9 0
	61	8, 11	2 16 6
	60	4, 10	3 16 0
	54	8	1 16 0
	53	11	2 7 6
	51	11	3 6 6
	50	10	4 1 6
	47	4, 10	3 6 6
	31	8	1 13 6
	30	6	11 3 0
West Basset	74	3	4 14 6
	72	8	5 16 6
	71	8	4 6 0
	70	8	4 1 6
	61	8	5 4 0
	60	8	7 11 0
	42	2, 6	7 8 6
	33	10	6 12 6
	24	8	5 4 6
	11	14	3 14 6
Carn Brea	112	2	0 3 0
	61	4	5 0 6
	59	4, 5, 7	7 6 6
	46	4	2 17 6
	45	10	3 4 0
	39	11	4 12 0
	32	4	6 9 0
	25	10, 11	3 3 0
Levant	86	9	6 0 0
	83	14	1 18 6
	60	10	6 5 0
	57	2, 6, 10	6 1 6
	7	14	22 13 6
	2	14	18 12 6
Par Consols	71	5, 7	7 17 6
	70	5, 7	10 19 6
	69	6	7 1 0
	40	9, 14	1 12 0
	36	11	3 14 0
Pendeen Consols	98	6	2 12 6
	45	6	2 17 0
	33	6	0 18 0
Pendeen Consols	30	6	£3 15 0
	6	6	8 16 6
Great South Tolgus	54	10	9 13 0
	52	4	6 2 6
	47	4	7 11 0
	45	8, 10	8 14 0
East Alfred Consols	100	2, 6	3 19 0
	41	2	3 15 6
	32	6	6 13 0
Charlotte United	52	10, 11	5 13 6
	43	5, 7	9 5 6
	38	6, 8	7 7 0
	22	11	2 14 0
Prosper United	73	6	5 19 0
	33	3	4 17 0
Copper Hill	45	6	1 18 0
	39	6, 8	6 17 0
	12	2	18 18 6
Botallack	39	14	5 12 0
	27	10	9 11 6
	22	7	4 18 6
Rosewarne United	45	11	5 9 0
	45	5, 7	8 12 6
West Fowey Consols	80	10	8 0 0
Treloweth	46	5, 7	6 11 6
	15	9	1 3 6
	14	6	12 15 6
Wheal Buller	36	11	2 11 6
	30	5, 7	10 0 6
Wheal Anna	27	2	3 5 6
	26	6	4 1 0
Wheal United Consols	24	11	6 6 6
Rosewarne Consols	18	6	7 19 0
	6	6	25 18 6
New Wheal Hender	16	8	5 16 0
	8	14	2 11 6
South Dolcoath	16	7	11 18 6
Great Work	13	14	7 0 0
Camborne Consols	11	8	9 1 6
West Tolvadden	5	9	3 8 6
	4	10	5 5 0
Trencrom	2	6	25 19 0

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.
Great Wheal Alfred	601	£1,982 13 6
West Basset	518	2,826 13 0
Carn Brea	419	1,496 6 0
Levant	295	1,592 13 6
Par Consols	286	2,011 0 6
Pendeen Consols	212	550 13 0
Great South Tolgus	198	1,585 19 0
East Alfred Consols	173	762 11 6
Charlotte United	155	1,032 12 6
Prosper United	106	594 8 0
Copper Hill	96	519 15 0
Botallack	88	585 5 6
Rosewarne United	83	573 0 0
West Fowey Consols	80	£640 0 0
Treloweth	72	479 4 0
Wheal Buller	66	393 9 0
Wheal Anna	53	166 14 6
Wheal Unity	24	151 16 0
Rosewarne Consols	24	298 13 0
New Wheal Hender	24	113 8 0
South Dolcoath	16	190 16 0
Great Work	13	91 0 0
Camborne Consols	11	99 16 6
West Tolvadden	9	38 2 6
Trencrom Mine	2	51 18 0

EACH COMPANY'S PURCHASE.

	Tons.	Amount.
1 Mines Royal	—	—
2 Vivian and Sons	282	868 19 0
3 Freeman and Co.	107	509 14 0
4 Grenfell and Sons	311½	1,654 14 5
5 Crown Copper Company	167½	1,462 15 5
6 Sims, Willyams and Co.	665½	3,381 0 6
7 Williams, Foster & Co.	205½	1,761 18 5
8 Mason and Elkington	682½	3,158 12 3
9 F. Bankart & Sons	126	582 15 0
10 Copper Miners' Compy.	486½	3,072 4 9
11 Charles Lambert	418	1,617 7 3
12 Newton, Keates and Co.	—	—
13 Alkali Company	—	—
14 Sweetland and Co.	183	758 7 0
	3624	£18,828 8 6

Average produce, 6½.
Quantity of fine Copper, 322 tons 18 cwts.

Average standard, £123 13s. 0d.
Average price per ton, £5 4s. 0d.

Copper Ores,

Sampled Feb. 5, and sold at the Royal Hotel, Truro, Feb. 20.

Mines	Tons.	Purchasers.	Price.		
von Great Consols...	134	7	£4	2	6
	130	2	3	9	6
	118	5,7	1	16	6
	117	2,7	3	18	6
	112	2	3	14	6
	111	2	3	17	0
	109	7	3	12	6
	108	3	1	9	6
	106	7	3	18	6
	105	2	3	15	0
	96	2,7	3	15	0
	94	14	2	18	6
	86	2,7	2	15	6
	85	11	2	12	6
	83	11	2	13	6
	82	4	11	5	0
	74	11	1	12	6
	71	2	2	18	0
	63	4	3	4	0
	58	11	2	13	0
	54	11	1	10	0
	53	2	3	14	6
	52	4	10	13	0
	46	14	2	13	0
	34	4	2	16	6
	33	4	4	17	6
the Valley	110	2,3	4	19	6
	101	2,4	4	4	6
	70	9	4	19	0
	65	14	3	15	6
	41	2	3	4	6
	34	14	3	7	6
Caradon	92	6	5	6	0
	85	11	4	18	0
	83	2	4	16	0
	63	6	8	16	6
	52	6	11	7	0
ix Mines	77	9	3	0	0
	75	8	3	10	0
	61	5,7	9	5	6
	60	2,10	3	19	6
	35	6	7	7	0
	25	8	11	16	6
Crelake	71	8,12	5	19	0
	63	4	3	2	0

Mines.	Tons.	Purchasers.	Price.		
Wheal Crelake	53	4	£5	14	0
	50	3	3	3	0
	48	3,10	3	12	0
	40	10	3	12	0
Great Wheal Martha ...	134	2,6	1	9	0
	67	2,6	1	19	0
	62	2,6	1	7	0
	34	2,6	4	5	6
Wheal Edward..........	84	11	2	6	6
	72	2,5,7,12	3	2	6
	64	8	2	17	6
	28	3	1	14	6
	23	10	3	1	6
	22	7,10	4	1	6
North Wheal Robert ...	68	10,12	6	10	6
	64	2,7	13	10	6
	52	2	2	11	6
	42	8	4	3	6
	14	10	19	12	0
Bedford United..........	111	6	5	0	0
	109	6	5	7	0
South Bedford	72	8	1	14	0
	59	14	2	3	6
	19	12	7	13	0
Wheal Emma	64	2,3	3	12	0
	47	5,7	9	8	6
	34	4	2	12	0
Sortridge Consols	72	8	5	4	6
	61	10	7	16	6
Wheal Arthur	68	10	2	1	0
	62	5,7	3	6	6
Wheal Friendship	87	2,7	7	9	6
	32	2,7	9	19	0
Harvey's Ore..............	42	6	1	5	0
	40	6	1	9	6
Okel Tor	80	8	2	9	0
Western Counties Reg. .	65	4,6	2	14	0
Devon and Cornwall ...	50	8	2	3	0
Brookwood..............	47	4	5	0	0
	3	2,7	18	10	6
Hawkmoor..............	31	7	6	3	0
Collacombe..............	30	6	5	2	6
Fursdon	25	6,7	7	15	0
Bedford Consols	21	9	2	9	6
Tavy Consols	13	9	2	16	6

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.		
Great Consols	2204	£7986	17	0
Valley	421	1812	6	6
aradon..............	375	2448	13	6
x Mines..............	333	1850	13	0
e..............	325	1394	6	0
Wheal Martha.........	297	554	0	0
Edward	293	812	19	6
Robert	240	1892	19	0
d United..............	220	1138	3	0
Bedford	150	396	1	6
Emma..............	145	761	15	6
ge Consols	133	853	10	6
Wheal Arthur..............	130	£ 345	11	9
Wheal Friendship..........	119	968	14	6
Harvey's Ore	82	111	10	0
Okel Tor	80	196	0	0
Western Counties Reg. ...	65	175	10	0
Devon and Cornwall.........	50	107	10	0
Brookwood	50	290	11	6
Hawkmoor..............	31	190	13	0
Collacombe	30	153	15	0
Fursdon	25	193	15	0
Bedford Consols..............	21	51	19	6
Tavy Consols	13	36	14	6

EACH COMPANY'S PURCHASE.

		Tons.	Amount.		
	s Royal..............	—	£ —		
	n and Sons..............	1324½	5251	14	6
	man and Co..............	297	840	6	6
	fell and Sons..........	544	3056	14	9
	n Copper Co..........	162	771	7	6
	, Willyams & Co.......	761½	3756	1	0
	ams, Foster & Co....	808	3911	10	9
8	Mason and Elkington....	515¼	£1930	16	0
9	Bankart and Son	181	606	4	0
10	Copper Miners' Co.........	305	1578	3	6
11	Charles Lambert..........	523	1411	18	0
12	Newton, Keates & Co....	106¼	634	13	6
13	Alkali Co. (Limited)......	—	—		
14	Sweetland and Co..........	218	885	6	0
	Total..........	5832	£24,724	16	0

e Produce, 5¾.
y of Fine Copper, 316 tons 2 cwts.

Average Standard, £128 19 0
Average Price per ton, 4 5 0

annot include *the last Cornish sale of the* month, as it does not take place until our *publication, the 27th instant.*

Black Tin Sales.

Date.	Mines.	Tons	c.	q.	lbs.	Price per ton £	s.	d.	Purchasers.	Amount of Money £	s.	d.
Jan. 1.	Great Wheal Busy	10	0	1	15	—			Carvedrras	626	15	
„ 5.	Wheal Tremaine	5	9	1	11	75	12	6	Mellanear	793	11	
	„	5	13	0	17	68	5	0	Treriffe			
„ 25.	Drake Walls	3	5	0	0	71	0	0	Harvey & Co.	1302	6	
	„	3	5	0	0	71	0	0	Calenick Co.			
	„	6	5	0	0	67	5	0	Enthoven & Sons			
	„	6	5	0	0	67	5	0	Calenick Co.			
„ 27.	East Wheal Lovell	1	5	3	8	69	10	0	Chyandour	89	14	[illegible]
	Treworlis	3	12	3	0	67	0	0	Ditto	259	0	[illegible]
	„	0	6	0	0	51	0	0	Ditto			
„ 28.	Great Wheal Busy	12	13	2	6	—			Carvedras	764	11	[illegible]
	Botule Hill	4	15	3	26	67	0	0	—	339	14	[illegible]
	„	0	3	1	17	67	0	0	—			
	„	0	3	1	17	40	0	0	—			
„ 29.	St. Day United	57	10	5	10	—			—	3468	8	[illegible]
	Basset & Grylls	22	13	3	25	—			—	1492	17	[illegible]
Feb. 1.	Gurlyn	4	11	0	0	66	0	0	Chyandour	300	6	[illegible]
„ 5.	Garlidna	8	18	3	11	70	5	0	Bissoe Company	758	16	4
	„	2	4	1	3	59	0	0	Ditto			
„ 6.	North Roskear	6	6	1	27	65	10	0	Treriffe	414	5	2
	Ashburton United	5	17	2	14	70	14	0	Harvey & Co.	1245	3	3
	„	5	18	3	10	70	13	0	Enthoven & Sons			
	„	5	15	3	12	70	14	6	Calenick Co.			
„ 8.	Penhalls	5	1	0	7	—			Carvedras	339	16	4
	Wheal Kitty	9	4	0	18	—			Ditto	570	17	11
	Great Wh. Fortune	15	4	2	18	—			—	1124	18	[illegible]
„ 11.	Redmoor	4	0	0	0	67	0	0	—	268	0	[illegible]
„ 12.	Wendron Consols	19	1	0	13	—			Chyandour	1290	16	[illegible]
„ 15.	Great Wheal Vor	21	10	2	4	—			—	1573	3	[illegible]
	Wheal Union	2	16	0	1	64	15	0	Trothellan Co.	181	6	[illegible]

Tin ores being sold by private contract, the particulars are not generally published or accessible. We hope, however, to be able to provide monthly a tolerably complete list of the sales of this metallic ore: the above list gives no idea of the real sales.

Sundry Copper Ore Sales.

Sold at LIVERPOOL, by Mr. JAMES HALLOWS.

Date.		Tons.	Price per ton £	s.	d.	Purchasers.	Amount of Money £	s.	d.
Jan. 28.	Lot 1 (ex *Hidalgo*)	55	23	15	0	Williams, Foster & Co.	8978	15	0
	2 „	55	23	15	0	ditto			
	3 „	55	23	15	0	ditto			
	4 „	55	23	15	0	ditto			
	5 „	55	22	15	0	ditto			
	6 „	55	22	15	0	ditto			
	7 „	55	22	15	0	ditto			

Sold at LIVERPOOL, by Mr. JAMES LEWIS.

Date.		Tons.	£	s.	d.	Purchasers.	£	s.	d.
Feb. 4.	Laxey (ex *Jane & Agnes*)	58	4	7	6	C. Lambert	333	4	6
	Ditto „	11	7	4	6	Newton, Keates & Co			
	Var (ex *John & Mary*)	33	9	6	3	James Radley, Jun.	307	6	
	Worthing (regulus)	15	51	9	0	Sims, Willyams & Co.	1542	0	0
	Ditto „	15	51	7	0	ditto			

Sold at LIVERPOOL, by Mr. JAMES HALLOWS.

Date.		Tons.	£	s.	d.	Purchasers.	£	s.	d.
„ 13.	Lot 1 (ex *Polestar*)	72	19	16	0	Sims, Willyams & Co.	8471	8	6
	2 „	72	19	10	0	Copper Miners' Co.			
	3 „	72	19	7	6	Ditto, and Newton & Co.			
	4 „	72	19	8	6	Copper Miners' Co.			
	5 „	72	19	14	0	Sims, Willyams & Co.			
	6 „	72	19	18	0	C. Lambert			

Sold at LIVERPOOL, by Mr. J. PITCAIRN CAMPBELL.

Date.		Tons.	£	s.	d.	Purchasers.	£	s.	d.
„ 21.	Lot 1 (ex *M. Banfield*)	33	1	17	6	J. Keys and Son	573	4	9
	2 (ex *Triglaf*)	35	3	4	6	Ditto			
	3 (ex *John & Mary*)	37	10	15	0	Newton, Keates and Co.			

Sold by the PARYS MINES COMPANY.

Date.		Tons.	£	s.	d.	Purchasers.	£	s.	d.
„ 18.	Lot 1 (copper ore)	400	4	18	0	—	3052	1	6
	2 (cop. precipitate)	42	16	4	6	—			
	3 „	38	5	19	0	—			
	4 „	20	9	4	6	—			

THE

MINING AND SMELTING MAGAZINE.

APRIL, 1862.

On the Mexican Method of Amalgamation.

BY JAMES NAPIER, JUN., F.C.S.,
Late Chemist and Assayer of the Guanaxuato Mint, Mexico.

§ III.—MATERIALS USED IN THE PATIO.

e materials absolutely necessary for the reduction of silver ores the Patio are but few, namely—sulphate of copper, or *magistral,* mon salt, chloride of sodium and mercury. But the various difications introduced have led to the employment of other ingre- nts, such as precipitated copper, copper amalgam, and fine algam.

1.—*Magistral, or Sulphate of Copper.*—This is manufactured from sulphide of copper, mines of which exist in many parts of xico; but, the district of *Tepezala,* about 18 or 20 leagues south- t of Zacatecas, and about 65 from Guanaxuato, perhaps supplies largest quantities of this ore for the manufacture of the sulphate. e following shows the per centage of copper contained in various ples from this district:—

Copper per. cent.	
13.00	
7.47	
13.75	
9.00	
12.50	=10.32 mean percentage of copper.
10.50	
8.60	
9.40	
8.73	

re are many much richer samples found in this locality, but these a very fair idea of the class of ores generally sent to the various ction works for the manufacture of the sulphate.

he sulphide of copper when brought to the haciendas is, like the r ore, first reduced to a coarse powder in the stamping mill, afterwards ground to a fine powder in the arrastres; but in ding this, much more is charged to the arrastres at once, and are discharged twice in the 24 hours. The ground ore is removed the arrastre to a small enclosure, where the water, with which as ground, is allowed to evaporate spontaneously, and where it

is allowed to remain exposed to the air for a length of time—
times two years—before being calcined. It is stated the longe
exposed to the air, the more sulphate will it yield; I have exa
various samples which had been exposed for a length of tin
sulphates, but have never found any.

The furnaces in which this is calcined are called *comalillos*.
have a double hearth; the roof is almost quite flat; and th
place is in the centre, and runs longitudinally, so that the
plays sideways. About eight arrobas of the ground ore (havin
viously had a few handfuls of common salt mixed with it) is ch
on each hearth. The fire is then gradually increased, and th
kept almost constantly stirred for the space of from six to
hours, when the doors and other openings are closed to ex
the air. When the whole is sufficiently cold to ensure no fu
calcination, the ore is drawn through holes in the bottom o
furnace into a place made for its reception.

The percentage of sulphate of copper obtained by this meth
calcination depends very much on the care which has been bes
on the operation by the workmen. The following table give
details of this operation as obtained in a few of the reduction
in Guanaxuato.

Name of Haciendas.	Sulphates per cent.		Total per cent. of sulphates availed of	Copper not availed of		
	Copper	Iron.		as sulphide.	as oxide.	b cal
San Joaquin	40.99	9.73	50.72	4.50	2.11	1
,, Nicolas	20.50	12.38	32.88	2.50	.23	
Granaditas	34.37	6.95	41.32	3.78	2.47	1
Salgado	24.64	7.40	32.04	—	2.50	
Pardo	33.18	6.75	39.93	3.00	3.50	1
Pastita	31.62	9.05	40.67	.70	.15	

In this table I give the amount of sulphate of iron as w
of the copper, because it is certain that the sulphate of iron als
in the process of reduction, although not so perfectly as the sul
of copper. A little of the copper given above as sulphate, will
the state of chloride, formed by the decomposition of the
portion of salt added to the ore before calcination.

In some districts sulphate of iron is mixed with the sulphi
copper previous to calcination. By doing this, ores containing
siderable quantities of carbonate and oxide of copper may be
for the manufacture of magistral.

The method employed by the amalgamators to know good
bad magistral, or rather to know the strength of it, is very
They take a small portion of the calcined ore in the hand;
gradually immerse the hand in water, and from the intensi
the heat given out, they judge of the quantity of sulphat
sample is likely to contain, and how much will have to be
in the process of reduction. They also like to employ the mag
as soon after calcination as possible, as by standing it ab
moisture from the atmosphere, and a larger quantity is requ

ll the sulphate of copper produced in the "*apartado*"* of the t, from the precipitation of the sulphate of silver by copper es, is used in the reduction works in place of calcined copper ites. In this case it is easy to calculate how much must be added a *torta*, and in using this torta is not augmented so much in k as when calcined pyrites is used.

—*Salt.*—There are various places in the Republic of Mexico re this article is obtained, but the principal localities are *Penon* co and *Salinas*. The former contains both salt lakes and springs; latter were discovered by an English gentleman, Mr. Pollard, was employed at this locality in extracting the salt from the h *(Saltierra)* of the lakes. The following analysis made at *Ecole des Mines, Paris*,† is of the salt earth from Penon blanco.

Chloride of Sodium	19.00	soluble in water.
Sulphate of Soda	2.20	
Carbonate of Lime	13.60	insoluble in water.
,, Magnesia	1.60	
Oxide of Iron	9.80	
Clay and Sand	46.20	
Water and Organic matter	7.60	
	100.00	

is class of salt earth was formerly used without refining in the ction works of Zacatecas, but the augmentation in the bulk e tortas in consequence of so much having to be added for the ose of obtaining the necessary amount of chloride of sodium, very inconvenient, and its use has consequently been given up. quantity of chloride of sodium contained in the purified salt Penon blanco averages from 80 to 85 per cent., the rest being ipally sulphate of soda.

the district of *Salinas* the salt is also found in springs. Here ish and German workmen are employed to extract the salt, h they do by evaporation in large pans. The following are yses of salt from this district, and such as is sent to the ous reduction works:—

	No. 1.	No. 2.	No. 3.	No. 4.
loride of Sodium	90.422	91.141	86.853	96.623
,, Magnesium	2.520	2.538	.044	.008
,, Calcium	1.310	1.574	.125	.114
lphate of Potash	3.556	3.141	.029	trace
,, Soda	—	—	12.949	3.255
,, Lime	2.192	1.606	—	—
	100.000	100.000	100.000	100.000

e purest salt that is met with in Mexico is sea salt, which ve found to contain, on various occasions, as much as 98.50

* The name given to the department for separating gold from silver.
† See Duport *De la production des Metaux précieux au Mexique.*

per cent. of chloride of sodium; but the great cost of carriage of this salt from the coast to the interior, makes it too costly to be generally used in the reduction of silver ores.

3.—*Mercury*.—This metal, the consumption of which is very large, is almost entirely imported, although it exists in many localities in Mexico. I have seen beautiful specimens of cinnabar—red sulphide of mercury—from Mazapil, and also from the Gigante near Guanaxuato, where some years ago a company was projected for the reduction of the ores; but works were never established, why I do not know. However, considerable quantities of mercury have, from time to time, been obtained from these mines. The district of El Doctor, about 150 miles to the north of the city of Mexico, has also yielded a certain quantity of this metal.

4.—*Lime*.—This is not a necessary ingredient in the Patio amalgamation. It is only used when an excess of magistral has been employed, and is then added in a caustic state, its object being to precipitate the excess of copper employed. Wood ashes are frequently added for this purpose instead of lime.

5.—*Copper Precipitate*.—In many of the reduction works this is used in preference to lime for counteracting the action of an excess of sulphate of copper added to a torta, which it does by reducing the protochloride of copper to the state of subchloride. It is prepared by suspending a mercury bottle in a weak solution of sulphate of copper, when the copper is precipitated in the form of a very fine powder. The use of copper precipitate in the Patio amalgamation was first proposed by Mr. Louckner, who also in conjunction with Mr. Henry Mackintosh, obtained a patent in Mexico for the use of *Copper Amalgam* in the tortas. The object of this was to save mercury; and if used skilfully it no doubt would; the patent, however, was evaded in many instances by using precipitated copper instead of amalgam. The amalgam used by Messrs. Louckner and Mackintosh, contained about 30 per cent. of copper. *Zinc amalgam* is also at times used with good results.

§ IV.—TREATMENT OF THE GROUND ORE (LAMA) IN THE PATIO TO OBTAIN THE SILVER.

The *Patio* is a large court yard well paved with flags, carefully cemented together to prevent, as much as possible, the mercury from passing between them. It is made on a slight incline, so that superfluous water, from rain, &c., may run off easily.

The ground ore from the arrastres is collected in a place called a *cajete* until it reaches a sufficient quantity to form a *torta* or heap—which generally contains from 50 to 80 montones—60 being the general size. The monton, however, varies in different places, as under—

In Guanaxuato, a monton contains	32	quintals.*
,, Real del Monte / ,, Pachuca and Saco	30	,,
,, Zacatecas and Sombrerete	20	,,
,, Fresnillo	18	,,
,, Bolanos	15	,,

* About 22 quintals make one ton.

en the necessary amount has been collected in the cajete, it is ed to a space prepared for it in the body of the Patio. This nclosure about 30 feet in diameter, made by piling two or rafters on each other, and securing them in their place by tones; the joints being made good by horse-dung. The lama not be much more than a foot thick; for the thinner it is, uicker will the operation of reduction go on. Here it is d to remain till as much water evaporates from it as to leave ar a thin mud. This condition being arrived at, the salt is added . operation is called *Ensalmorar)* in the proportion of from o five per cent. on the weight of the ore; this, however, will l somewhat on the quality of the salt used, and on the nature ores under treatment, but I now speak of salt such as that d to in the analyses given. It is well known that those who most salt, up to a certain point, will get out the silver in the t time. Some amalgamators will never use more than 3 per lt, although they are quite aware the operation would be ted six or eight days sooner had 5 per cent. been used; but, e gained will not compensate for the extra salt used. My Don Juan B. Castelazo added by mistake to a torta double antity of salt necessary; and the consequence was that the on was concluded in 10 days instead of about 25—the usual quired for ordinary ores.

n the requisite quantity of salt has been added, the torta s a *repaso* or *treading* (which will be described further on). en allowed to rest till the following day, when the whole of t ought to be in solution, and thoroughly mixed with the

porar, (addition of Magistral and Mercury).—The day after t has been added, they proceed (after bringing the torta to a consistency with water), to add the necessary quantity of *al*. If this be of an average quality, for instance like that in the preceding analyses, it is added in the proportion of alf to three-quarters per cent. on the ore, or about an arroba monton of ore in the torta. It is thrown as evenly as possible e whole surface of the mass by means of wooden shovels; hen the whole has been added, the mules are admitted to r—*tread*—for about an hour for the purpose of mixing the as thoroughly as possible. When this has been completed, ercury is then added in the proportion of from 3½ to 4 lbs. ry mark (half pound) of silver contained in the torta. This y is introduced in a very fine shower, by being pressed h a linen sheet so as to divide the particles as much as e. The torta, when the mercury is added, should not be t, otherwise the mercury would be apt to collect into large s again;—neither should it be too dry, as the mercury in that ould become too much divided, and thus cause a larger loss ecessary in washing;—it should be of such a consistency, e animals can, in treading, go through it with comparative nd yet leave the marks of their feet when removed. Immeafter the addition of the mercury the whole is again trodden out four or five hours, for the purpose of incorporating as ly as possible the whole mass.

When pure crystallized sulphate of copper is employed, instead of common calcined pyrites, there is added from 10 to 14 lbs. for each monton of ore in the torta.

When the magistral and mercury have been added, and a repaso given, the torta may be said to be in working order; and it only remains for the *azoguero* or amalgamator to watch attentively its daily progress by repeatedly taking out *tentaduras*, samples:—the colour and general appearance of the mercury being the only guide to the whole operation.

A short time after the incorparo, the azoguero takes out a tentadura from the torta; washes away the earthy particles, and carefully examines what remains, which is composed of *polvillos*—metallic sulphides—and mercury. If the latter be rubbed with the thumb, or pressed through a piece of leather, but very little amalgam will remain. The colour of the mercury, in this case, is only taken notice of; and if it has altered a little from its natural colour, with a slight tinge of yellow, it is a sign that sufficient magistral has not been added; or if the mercury be divided into small particles it is a similar sign. If it partakes of a lead or deep grey colour, it is evident that an excess of magistral has been added, and the torta, in such a state, is said to be *caliente*—hot—which is very prejudicial, and causes an unnecessary loss of mercury. For this reason it is always better to err in adding too little than too much magistral. If the right quantity required be put upon it at first, it is a great object gained, as the torta at once falls into good working order and goes on, barring unforeseen accidents, with but little trouble to the end of the operation. When a torta is in good working order, the surface of the mercury is of a distinct light grey colour.

The day after the incorparo (should the magistral have been added in proper proportion), a very different appearance is presented in the tentadura. There is found collected mercury which when pressed by the thumb yields amalgam of silver; and what was in the first trial *desecho*—broken-up mercury—appears now as what is termed *limadura de plata*, of a whitish colour, and in the form of thin plates or leaves which, if rubbed with the thumb, will be found to consist of dry silver amalgam called *pasilla*. It is from the appearance of this that it is known when the operation is going on well. If pasilla be formed in a very short time after the ingredients have been added, it is certain they have been added in proper proportions.

To make a tentadura, about 1 lb. of the lama taken from various parts of the torta, is put into a jicara, and slowly washed in water contained in a convenient vessel. The jicara is gently moved about in a peculiar manner so that the lighter part only is washed away, leaving in the jicara the *limadura de plata*, (small leaves of amalgam); the mercury with its *lista*, or tail; and a portion of the polvillos, or heavier metallic sulphides of iron, &c. There is now added to the jicara about a tea-cup full of clean water; when it is inclined to one side in the hand, and a gentle but peculiar movement given to the water so as to arrange the contents of the jicara in the following order:—The limadura or broken up *lis* of mercury should occupy the first or upper part; the metallic portion of the ore should be below this; and, last of all, the mercury and amalgam as a large

ule. As I have stated before, the limadura is the most important , and is inspected first; this is done by holding the jicara in right hand in an inclined position, and rubbing the limadura the thumb of the left hand, at the same time observing with care its colour—the facility with which it can be converted malgam by the friction—and of the consistency of the result-malgam, that is to say, whether it contains a large or a small nt of mercury. The metallic portion, or povillos, is not of importance, as the state of the amalgamation cannot be d of from it. The globule of mercury at the bottom is lastly ned as to the colour, and the quantity of amalgam which it ns is ascertained by pressing it with the thumb on the side of cara.

se tendaduras are commonly taken from the surface and r of the torta. The surface is always the most forward from ing most exposed to the action of the air and sun. Three uras, or trials, are made of each torta daily; one in the morn-fore commencing to tread; one after it has been trodden for time; and a third after the treading is finished.

en the operation approaches conclusion, that is to say, when the whole of the silver capable of being taken up has been ted, the limadura becomes *weak*, and upon being rubbed with umb shows but little amalgam. When it ceases to do so ther, feels soft, and combines into small globules which run to the bottom of the jicara, the amalgamation may be con-d finished or *rendido*. However, in some cases, a torta may the signs in this respect of being finished, when in reality it ; for this reason, the *asciento*, (metallic portion, or polvillos, ning in the bottom of the jicara,) is also examined by extend-out over the jicara, and rubbing the small prills collected there he finger. If these unite into running mercury, then there is ıbt about the operation being finished; but should they form nalgam, it is not so, and the operation must be continued until s the case.

he *beneficio* (amalgamation) be low or cold, these signs are de-e; consequently it is better to carry the torta *rather hot* than At the present day the amalgamators, besides being guided e above signs, also make an assay of the torta, by taking rage a sample as possible from the heap—washing it and col-the whole of the mercury and amalgam, and having it assayed. is means it can be easily calculated how much silver the whole mercury present ought to contain.

ding; and turning over the Torta.—The operation of treading ied on almost exclusively by mules or horses; and it is re-every other day until the end of the operation. One mule to two montones* is about the number employed. They are tied er four abreast, and blinded, and a man stands in the centre torta, holding a halter attached to the animals to guide and them through the mass. They first commence to tread at the r border of the torta, and very gradually work into the centre,

* A monton of 32 quintals.

which ensures the whole mass being thoroughly trodden. The operation lasts from about 6 o'clock in the morning till about 1 or 2 in the afternoon. Besides this treading, the tortas are also turned over twice a week by men, by means of wooden shovels. This is done on one of the days of the treading, and is commenced immediately on the removal of the animals from the tortas.

Animals are kept exclusively for the purpose of treading; and very frequently, when they become old and die, a ball of amalgam, weighing at times many ounces, is found in their stomachs. This is easily accounted for, for when they come from a torta they often commence to lick themselves, probably for the salt which may adhere to their bodies, to which also a considerable quantity of very finely divided amalgam may have attached itself. This latter passes into the stomach where, in the course of years, it accumulates into a large piece. These pieces of amalgam are extremely heavy and solid, and vary in size from a small nut to a large egg. The animals, as soon as they have finished treading, are well washed in a large tank of water.

It is believed by many that no means of repaso or treading, except that of animals, can be effectual, the reason assigned being that animals have the power of imparting or exciting a slight electrical action in the mass. This, however, has been entirely disproved by some amalgamators using machines in place of animals, and obtaining equally good results. I have no doubt machines will, before long, be entirely used, instead of animals, for this purpose.

Washing.—Where the amalgamation is considered complete, some amalgamators, previous to washing the torta, add to it a portion of fresh mercury which is called bano—bath—for the purpose of collecting as much as possible the finely divided amalgam. However, others prefer using a larger quantity of mercury in the torta, from the commencement and adding no bano. The next thing to be done is to separate the amalgam from the vast amount of earthy matter with which it is associated, which is done as follows, in most of the well conducted works:—There are arranged in a shed—*lavadero* or washing-house—three large round tanks, built close together in a circle, and communicating with each other by means of an oblong opening about 13 inches high and 8½ inches wide, commencing at about a foot from the bottom, and terminating at about the same distance, or a little more, from the top. These tanks—tinas—are built of stone-slabs, which have to be very carefully cemented together, particularly those at the bottom, as much of the mercury might be lost. In the centre of each tank there is an upright shaft, carrying four cross arms, to which are attached long wooden teeth or stirrers, the whole being moved by one mule. The pinions which move the agitators of the second and third tank are a little larger than that attached to the first, so as to give them rather a slower motion. The tank into which the metallic mud is first thrown is called *la tina cargadora*—(the charging tank)—and the last one the *descargadora* or discharger. The torta, before being washed, is divided into a certain number of parts; each part, before being taken to the washing-house, being softened with water and a treading. A given portion—which is measured by large wooden bowls—of the lama is thrown into the first tank (*cargadora*), water being

allowed to run in and the machinery being made to revolve rapidly (the driving mule going at a gallop) at the time of charging, so as to break up and separate the whole mass as much as possible. Little by little the mule is made to go gradually slower and slower, till at last it only moves at a gentle walk: the mules being specially trained to the different paces required. From time to time the *azoguero* removes a portion of the slime under treatment, and washes it in a jicara:—from the amount of mercury remaining at the bottom—which at last ought to be a mere trace—it is judged when the water holding the earthy particles in suspension may be run off. This is done by opening a large plug near the bottom of the last tank—*descargadora*. When the whole has run off, the plug is again put in, and the operation continued in a similar manner until the whole torta has been washed.

Besides the fluid amalgam which remains at the bottom of the tina, there is also a quantity of the heavier portions of the ore—*cabezilla*—which is very rich in amalgam. This is removed in wooden bowls to a tank—*pila apuradora*—and thrown into a large bowl called a *batea apuradora*; these vary from three to five feet in diameter, and float on the surface of the water. The person who manages this batea leans over the side of the pila, and with a hand on each side of the batea manages to give it a peculiar shaking or rocking motion, at the same time constantly dipping up a small quantity of water, which he washes round the batea and then throws out, carrying with it a portion of the *cabezilla*.

This is repeated till there is collected from 20 to 30 lbs. of *pella*—amalgam—which is carried to the *azogueria* (mercury house), where it is deposited in a large stone trough. When the whole of the amalgam from a torta, or as much as the trough will conveniently hold, has been collected, a large quantity of pure mercury is added, and also a gallon or two of water. Two men next thrust their right arms into the amalgam and stir it about in every possible direction for some time, for the purpose of cleaning it as much as possible. Every now and again the matter which collects on the surface is removed, as is also the water, and the operation repeated time after time until the surface of the amalgam presents a bright smooth surface, when it is very carefully wiped with a woollen cloth.

Pressing Amalgam or Pella.—When the amalgam has been properly cleaned as above, it is removed into a cone-shaped *bag-manga*—made of sail-cloth with an outer covering of leather on the sides. This manga is hung from a beam, and the excess of mercury filters through the canvas bottom into a trough beneath it. The amalgam is allowed to remain in the bag, as a general rule, about two hours, when it is emptied out on to a table. It now presents the appearance of very fine sand; and in this state is next beaten into iron moulds, and formed into bricks—*bollos*—of about three or four inches thick, and wedge-shaped, so that when six of them are placed together they form a circle, leaving a round hole in the centre for mercurial vapours to pass through in the next operation.

Burning.—The final operation is to expel the last traces of mercury from the silver, which is done under a large copper bell. Below the floor of the burning house there is a tank, through which a stream of cold water is constantly flowing. In this a round tripod is placed,

on the top of which is laid a round iron plate, with a hole in the centre, about two inches in diameter. On the top of this is placed the bollos of silver, as high as the bell will admit, there being a space of about an inch left between the silver and the side of the bell. This is now lowered on to the top of the silver, the joints at the bottom being well secured. There is next put round the bell (leaving a space of about six or eight inches) mud bricks or *adobes*; the intermediate space being filled with charcoal. This is now ignited, and as the heat increases the mercury begins to pass off into a receptacle below. The fire is kept up for about 12 or 15 hours, when the whole is allowed to cool, and the bell removed. The silver is then found to have a beautiful honeycomb appearance, and is called *plata pina*. In this state it is removed in leather bags to the government melting and assay office to be run into bars.

It may be worthy of remark that silver produced by the patio amalgamation is purer than that produced by any other method. I have often seen it produced in Guanaxuato as fine as that specially prepared in London for check silver.

The duration of the amalgamation process is very various, and depends on many circumstances. About 25 days may be taken as the average time to work a torta.

Loss of Mercury.—There are two sources of loss of mercury in this operation. One is called the *consumido*, or the portion required to reduce the silver to the metallic state; in practice, weight for weight is allowed, the correct proportion being as 100 is to 108. Every thing lost beyond this is called "*perdida.*" It may be taken as a general rule that from 10 to 16 ounces of mercury are sacrificed for each mark (8 ounces) of silver obtained.

Loss of Silver.—The loss of silver in this amalgamation process is considerable and varies much according to the class of ores operated upon, and particularly on the quality of the grinding, on which depends very much the success of the operation. From 10 to 14 per cent. is an average loss on docile ores; much of this, however, is lost in the form of amalgam from being carried away in fine particles by the water used in washing the tortas; but if more perfect washing vats were employed I have no doubt but the loss of silver could be much decreased.

(To be concluded in our next.)

Faults, Dislocations, and Disturbances in Coal Mines.

By Mark Fryar, F.G.S.,

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Dislocations of strata, and other disturbed conditions of coal beds, are so frequently met with in mining operations, and are so intimately associated with plans for colliery workings, that an acquaintance with their leading features is indispensable. All proposed plans for

ying out" the underground works of mines are likely to be interd with, and greatly modified by "faults;" and, indeed, the thods of working the coal, and the system of ventilating the ie, are in many cases adopted as being most suitable for the isturbed strata," in which the coal seams occur.

The terms dislocation and displacement, when applied to these logical accidents, are easily understood by any one; but the inical names commonly used in mining districts seem to require e explanation, and more clearly-defined application than they at sent possess. The name "fault" may be very appropriately lied to all kinds of alterations in the rocks, by which the position form of the beds or lodes of mineral have been in any way nged from their original relative places or conditions; and may s be used to include all alterations of mineral deposits from a d marketable quality to an inferior and useless description. The er kind of changes, or where there is merely a slight interruption the uniform character of a bed of coal, either as regards its quality any very sudden change in the plane of its bed, is generally called colliers a "trouble." The names "dyke," "slip," "hitch," lide," "heave," "thing," "Vs," "nip," "want," "throw," hift," "float," "check," "balk," &c., are all of them given to different kinds of "faults" and "troubles" which are so quently encountered in all kinds of mining, and most of them only localisms, the miners in each large mining district having ir own names for each particular kind of fault. When referring instances of disturbance, illustrated by the wood-cuts, I shall show w these names are applied.

"Trap dykes," or what are sometimes called by miners "whin kes," are masses of hard feldspathic or hornblendic rock—or netimes a mixture of these two substances, and then called greenne—which have been intruded between the planes of fracture, ereby preventing the dislocated beds from settling back into their mer position. In some cases these trap intrusions may indeed rease the dislocation; and when we consider the very extensive -heavals of trap, such, for instance, as are to be met with in rious places in the coal field of Scotland, we have before us a st fertile source of dislocation, and other kinds of disturbance.

The unmistakeable effects of intense heat are found to be almost variably associated with the dykes of trap as they are met with in l and iron-stone mines. A familiar instance of this has long en known in the case of the 90 fathom or Cock-field-fell dyke of rthumberland, from 18 to 20 yards thick, where the coal, for 50 rds on each side, is said to be converted by heat to a condition fering widely from its original one. The first appearance of ange in the coal when approaching this gigantic wall of trap the disappearance of calcarous spar from the joints and backs, d the alteration in the lustre of the coal from a bright shining ack to a dull sooty kind. The coal-bed becomes gradually less, til from six to eight feet—its ordinary thickness—it is reduced xt the dyke to nine inches, the coal in this position being conrted into "dawk" or "swad" (consolidated soot), while at a greater stance from the dyke it is changed into a hard cinder. The roof the coal seam is said to be full of brasses (iron pyrites). In the

Scotch coal field, the coal of the whole colliery districts is altered b[illegible] the same kind of agency, and ordinary black-band iron-stone [illegible] found to be completely calcined and rendered magnetic.*

A good example of a very large trap dyke, of from 250 to 30[illegible] yards in width, may be seen in the grounds of the Glasgow Necro[illegible]polis. It has been penetrated to a considerable distance by quarry[illegible]ing for paving stones, and the structure of the trap—its frequen[illegible] columnar feature—may be seen there to advantage.

Some large specimens of burnt coal, which have been supplied t[illegible] me from the Newton pit, near Glasgow, by the kindness of M[illegible]. James Smart, exhibit also a columnar structure of remarkabl[illegible] regularity; the columns being each about half-an-inch in diamete[illegible]. This somewhat uncommon feature in the "altered coal" is doubtle[illegible] owing to the same process as that by which columns of basalt ar[illegible] said to be formed—that is, the escape of heat from as many centre[illegible] of cooling as there are columns of the material—this radiation of heat from the respective centres tending to produce, from an original globular mass, a cylindrical column; but a prism resulting from the resistance of each radiating force by the surrounding and counteracting forces.

Examples of trap dykes, and of various forms of interstratified trap, are so numerous in the Scotch coal field alone, that a minute description of the whole of those which have been met with in the coal and iron-stone mines, would be quite sufficient for a large volume on the subject. An interstratification of trap (felstone containing small threads of satin spar) has been passed through by a "drivage" under the superintendence of Mr. Stokes, measuring about 64 feet. The coal is hard and "brassy" on each side of this "tongue" of felstone, and exhibits such indications of having been once exposed to heat, as to lead the colliers to give it the name of "burnt coal." From the "Records of the Government School of Mines," it appears that sheets of green-stone have been similarly injected in the mining district of South Staffordshire, over an area of more than 20 square miles, varying from 15 to 60 feet in thickness. The coal which has been altered by these trap intrusions is called, by the Staffordshire colliers, "brassil"—a very appropriate name, when we remember that "brass" is a very old mining term for iron pyrites.

"Dyke" is a North British name for a stone wall, and as far back as the last year of the past century, we find a Welshman, who had been many years a mining engineer in Scotland, writing—"I suppose that this species of coal-trouble was first called *dyke*, from the resemblance of some of the lesser hard ones to a stone wall, or stone dyke, some of them being no thicker than a common garden wall; however, these dykes vary greatly in thickness as well as in quality, and the matter of which they are composed. They vary in thickness from two or three inches up to a great many fathoms: nay, in some instances, the thickness is too great to be pierced through with a "mine;" in which case the miner is obliged to abandon the present pits, and to search for the coal upon the other side."

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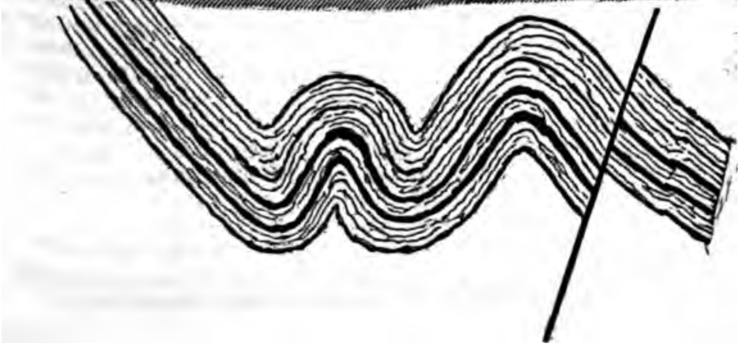
* I am indebted to Mr. Arch. Grey, of Dalry, for specimens of "burnt ore" from a trap dyke in one of Messrs. Merrie and Cunningham's pits.

The sheets or interstratified "flows" of trap can be easily distinguished from the dyke of trap, as the former present a very irregular line of junction with the coal, and are bounded by the planes of the roof and floor of the coal seam, like the coal itself; while the latter present a more regular face to the coal, and intersect the plane of the floor, passing downwards to unknown depths, and in the majority of cases also passing upward through the roof to the surface, or at least to the top of the coal-measures.

When a "slip" or a "dyke," is arrived at by an exploring drift in a mine, the important question to be solved, is the direction in which the displacement of the strata has taken place. An old and very safe practice in determining this, is to depend upon an acquaintance with the strata. For example, if in working a coal seam and passing through a slip fault any stratum should be recognised as being indentical with what was known to be 108 feet above, it would be sufficiently reliable evidence that the coal seam would be found the same distance below, and *vice versa*. There is, however, an almost invariable "law of faults" by which a solution of this problem may be determined irrespective of this practice; indeed depending on a recognition of the strata after passing through the "Vs," or planes of a fault, is very liable to failure, as the recognition may not be a certain one, or the strata may be so entirely new to the observer that recognition is impossible. The "law of faults" may be stated as follows:—If the plane of the coal bed makes an obtuse angle upwards with the plane of dislocation, the fault will be an "upthrow." If this angle be acute, the fault will be a "down-throw." In the case of very highly inclined beds of coal or of mineral lodes, this law may be stated thus:—If the angle contained between the left-hand wall and the face of the fault be obtuse, it will be a "right-hand" heave; if this angle be acute, it will be a "left-hand" heave. The following more simple and "practical" language expresses the same law:—In the case of coal beds,—if the coal is lost in the "sole" or "pavement" first, the fault will be an up-throw; if in the roof first, it will be a down-throw. In highly-inclined coal seams, or in mineral lodes,—if the mineral is lost first on the right-hand wall, the fault will be a heave to the left; if the mineral be first lost on the left-hand wall, the fault will be a heave to the right.

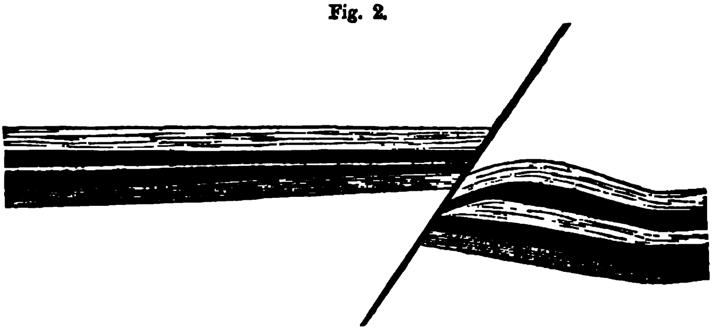
Fig. 1.



The dislocation, illustrated by Fig. 1, of a fault which seems to have been met with since I examined these contorted coal beds in a coal mine at Warmley a few years ago—appears to furnish an exception to the "law of faults" referred to. I am indebted to Mr. Stewart, of Bristol, for the particulars of this displacement, and if in this case there really is an exception to the general law, as is shown by the sketch, it may doubtless be accounted for by the peculiar agency through which the fault has been produced.

The amount of displacement of beds by either a "slip" or "dyke" fault, or what is known by miners and geologists as "the throw of the fault," varies from a few inches to 1000 yards. A "hitch" is where the "throw" does not exceed the thickness of the coal seam. Figure 2, is an instance which has been supplied to me from measurements by Mr. Carey, of two coal beds being brought very nearly on the same plane with each other by a slip fault, while under ordinary circumstances they are 15 or 16 fathoms apart. The *rough main*

Fig. 2.



Rough Main Seam. Splint Main Seam.

coal shown here averages about three feet in thickness, and is separated in the middle by four inches of shale. The *splint main* coal is from five to six feet thick, and has a shale parting in the middle of about two feet in thickness. This seam has evidently been raised up through the greater part, if not through the whole, of the amount of throw: the effect of the upward thrust is seen on the bend of the seam at A, and on the ends of the coal, and the associated strata, being turned downwards towards the Vs or plane of fracture. The thinning out of the *rough main* seam towards the slip is remarkable in this case, although, in connection with faults where the fissure has been filled up with trap, this alteration in a coal bed seems to be no uncommon occurrence. In both cases it is doubtless owing to the escape of a large portion of the coal under the condition of a gas, during the period of displacement, caused, in the one case, by the heat of the molten trap combined with that arising from friction, and, in the other, by the heat from friction alone. From a consideration of the way in which the forces have operated to produce the phenomena observable in this slip fault, it is easily seen that the pressure upon the *splint main* coal, and the effect of rubbing against the broken ends of the opposite strata, would be such as to prevent the escape of gas from the seam, even supposing that there might be access to it for atmospheric air to

admit of the decomposition of the coal; while, on the other hand, the effect upon the *rough main* seam would just be such as to facilitate the rapid decomposition of the coal, and the liberation of the gaseous products. The thining of the bed, and a perceptible alteration in the character of the coal, is observable in this case through a distance of 60 feet.

(To be concluded in our next.)

Abstracts and Reviews.

OBSERVATIONS ON SILICA.—By Arthur H. Church, B.A.

(From the Journal of the Chemical Society.)

The recent researches of Mr. Graham in dialysis have shown us how to prepare a pure aqueous solution of silica of considerable strength and with great ease. Pure water, according to Kirwan, is capable of taking up no more than one-thousandth part of its weight of hydrate of silica freshly precipitated, while there it no difficulty in obtaining, by the dialytic method, a liquid containing fourteen per cent. of that substance. The other processes for procuring silica in solution are less satisfactory, for it is difficult to free the product from hydrosulphuric acid when sulphide of silicon is used; and on heating gelatinous silica with water in a glass tube under pressure, the glass is acted on, and a portion of alkaline silicate formed.

A solution of silica containing more than 0.5 per cent. of the anhydride cannot be kept long without change; but I have observed no alteration as to transparency or fluidity in a solution containing 0·47 per cent. after the lapse of three months. With respect to stronger solutions, the process of gelatinization is generally more or less gradual. Freshly prepared, a solution containing 3 per cent. of anhydrous silica was perfectly limpid, and nearly as mobile as water; after the lapse of six days it acquired the consistence of glycerin, and then rapidly became ropy, the silica separating in gelatinous masses. The solution in this case was kept in a well-stoppered bottle. Solutions of silica obtained by dialysing an alkaline silicate after addition of hydrochloric acid, seem, according to my experiments, to retain their fluidity longer than those of the same strength where sulphuric acid has been used; and as a general rule, the purer the solution and the freer from acids and salts, the longer may it be preserved without change.

The cholrides of barium, strontium, and calcium, and many other salts, produce no immediate precipitate in an aqueous solution of silica; but solutions of the alkaline earths at once throw down the whole of the dissolved substance; or, if they be added in insufficient quantity, the silicate formed causes the remainder of the silica to separate as a jelly. This action is still more prompt if the carbonates of calcium, strontium, or barium be made to react upon the silica solution. One milligramme of pure carbonate of calcium in fine powder was put at the bottom of a beker, and then 100 cubic centimetres of a 1 per cent. silica solution were poured upon it; in ten minutes, the mixture was a firm jelly, and the vessel could be inverted without the loss of any of its contents.

I cannot but think that this singular deportment of the aqueous solution of silica with the carbonates of the alkaline earths tends to throw great light upon several important geological and mineralogical questions. Silica, we know, is almost an invariable constituent of the waters of the earth, and in several cases it exists in solution in considerable quantity, rather as silicic acid

than as an alkaline silicate. Several springs in Iceland, at Luzon, in the Philippine Islands, and in New Zealand, deposit a beautiful quartz-sinter containing scarcely more sodium and potassium than common flint. But the action of far weaker solutions of silica may, I believe, be traced very frequently in less striking but more common conditions. I have endeavoured to test this supposition by a series of experiments, an example of which I will now describe.

A curious silicified substance, at once a mineral and a fossil, occurs in the triassic red conglomerate of Torbay and its neighbourhood; similar, if not identical, bodies are found in other parts of great Britain, and also in a few foreign localities. This mineralized fossil, to which the name of "Beekite" has been assigned, presents itself under such a variety of aspects as to baffle description, so far as regards its physical features; its chemical composition is more constant. Originally corals or shells, and therefore, consisting in great measure, of carbonate of calcium, beekites have become so modified in constitution as to contain on an average, no less than 92 per cent. of silica; a small but variable amount of calcium occurs in them, but this exists as silicate rather than carbonate; a few exceptional cases have been noted, where the process of silicification has been arrested before completion, and where the interior of the beekite may be completely dissolved away by hydrochloric acid, though the outside is not affected by this reagent. I have attempted to transform corals and shells into a substance resembling that of which beekites consist. The trial is made in this wise. A fragment of recent coral was fitted tightly into the neck of a funnel, and a solution of silica in water containing dissolved air and carbonic acid was allowed to fall upon it drop by drop. The liquid which filtered through contained much carbonate of calcium, but no silica, while the coral ultimately retained very little carbonate of calcium. The silica solution should be very dilute, about 0·15 per cent., otherwise part of the silica will gelatinize on the surface of the coral and prevent further action.

I have endeavoured also, to illustrate, by means of the aqueous solution of silica, that tendency to deposition, in a circular or globular form, which is so marked a characteristic of many siliceous minerals, such as quartz-sinter, eyed agate, bubble-chalcedony, and especially beekite. In the latter case, the surface of the specimen generally shows a number of tubercles surrounded by systems of concentric ridges. So strongly is this circular tendency developed in some instances, that a fragment of a silicified pecten, in my possession, shows a system of rings, partly situated in a furrow of the outer aspect of the shell, then bent upwards to follow the natural curve of a ridge, and then turned down into another furrow. I was anxious to see whether such circular forms could be attained artificially, and the more so as Mr. Rainey has obtained similar globular crystals of carbonate of calcium. Although I have not at present arrived at any definite conclusion on the subject, I have yet observed, in working with an aqueous solution of silica, several phenomena which may suggest an answer to the question. Among these phenomena the following may be mentioned: the irregular spherical masses into which a solution of silica often dries up in the air, the faint curved markings developed in a piece of oyster-shell after artificial silicification, and the singular narrow flakes into which the film of silica, forming round and just above the margin of aqueous solution, when evaporating in a dish or beaker, divides. These narrow strips curl inwards, the ends meet, and the rings or sections of cylinders thus formed accumulate in the liquid, presenting an appearance of great interest, the origin of which was not at first sight apparent.

PREPARATION OF BRASS.

(From Dr. Percy's "METALLURGY.")

comparatively recent period, all brass was made by the odd
of *cementation*, which has been almost entirely superseded by
alloying zinc in the *metallic* state directly with copper. This
process, which has been practised for centuries, was, never-
patented in this country in 1779, by Mr. John Champion,

MANUFACTURE OF CALAMINE BRASS.

a few years ago, I saw the old process carried on in Bir-
n, at Mr. Pemberton's works, the last which survived in
m; but they have since been pulled down, and I am not
hether a single calamine brass furnace is now in operation
and. In 1859, I found several of these furnaces still in
e at the copper-works of Messrs. Sims, Novill and Company,
, Glamorganshire, and there are others, I am informed, at
.. I am indebted to the kindness of the firm just mentioned
nission to examine them, and take the measurements. I
o pleasure in stating that I received much of the following
ion concerning the mode of conducting the process, from the
. Joseph Stringer, who had been during a long period in
ploy, and who had superintended the furnaces.

ption of the Furnace.—It exactly resembles, in all essential
he furnaces represented in the engravings contained in old
gical treatises. It consists of a circular chamber, lined with
:; it is contracted above to a circular opening, the mouth, in
s fixed a cast-iron collar; it is closed at the bottom by a
cast-iron plate or bed-plate, in which are 12 holes sym-
ly arranged round one larger hole in the centre, through
he ashes and clinkers may be withdrawn from time to time;
e bed-plate is the ash-pit, communicating in front by means
ched air-way, with a long arched passage or vault, through
ir is conveyed to the furnace from the outside, and the work-
ain access to the ash-pit. Over the small holes in the bed-
e placed short nozzles or twyers of cast-iron, tapering
, the larger central hole being left without a nozzle. The
are 6 inches high, 2½ inches in diameter at the bottom, and
t the top, inside measure, and three-quarters of an inch in
s. The space between the nozzles is filled up level with bricks
lay, so as to form a solid bed 6 inches thick. The air which
combustion enters through these nozzles, which are used as a
te for bars. The furnace is enclosed in a solid mass of brick-
and for the sake of strength, at the back of the arch over the
, and in front of the bed-plate, is placed an iron bar resting
e walls, which form the sides of this air-way. Several of
rnaces are constructed in a row, and over the whole is built
of brick covered in with a large brick cone open at the top,
like an ordinary glass-house. It will be perceived that the
has no chimney, except the mouth, which is kept more or
ed, according to circumstances, by a circular cover of cast-
of fire-brick set in an iron frame.

1779, November 21, No. 1239. Abridgments—Metals and Alloys, p. 22.

Crucibles.—The crucibles employed are made of fire-clay. They are circular, and 12½ inches deep, 8¼ inches wide at the top, and 6¾ inches in the middle, inside measure; they are 1 inch thick at the top, and 2 inches thick at the bottom. Mr. Stringer informed me that he was always accustomed to employ a slightly larger crucible, which is termed the *king-pot*, in the centre of the bed-plate; but another calamine brass maker, of great experience, tells me that there is no necessity for this variation in the size of the crucibles. According to Mr. Stringer, the *king-pot* should be 13½ inches deep, 8½ inches wide at the top, and 7¾ inches wide in the middle; 1¼ inch thick at the top, and 2 inches thick at the bottom. Such a crucible will hold 120 lbs. of metal, while one of the smaller size will only hold 84 lbs.

Composition of the Charge.—Calcined calamine or blende calcined *sweet* and ground fine, 100 lbs., ground coal, 40 lbs. These are intimately mixed *dry*, and passed through a sieve of 8 holes to the linear inch. The mixture is then spread level, and 2 gallons of water are poured upon it; after standing half an hour, it is again well mixed and passed through a sieve of 4 holes to the linear inch, after which it is levelled and thoroughly mixed with 66 lbs. of *bean-shot* copper. The mixture should be sufficiently moist to adhere together by pressure with the hand. It is now ready for charging, and produces brass for the *best battery* purposes, *i.e.* brass intended for hammering, &c.

Mode of Charging.—It is supposed that the furnace has become previously heated in the regular course of working. The pots are charged with care, moderately lightly, and covered; the central hole in the bed-plate having been previously stopped with clay. Four flat pieces of coal, each about 15 inches long, from 3 to 4 inches thick, and 8 or 9 inches wide, are placed so as to form a cross over the pots, one end of each piece resting on a side-pot and the other on the king-pot. 3 cwt. of coal broken in pieces a little larger than the fist are then carefully put into the furnace, the fall of the coal being broken by placing a pair of tongs in the mouth, which is afterwards partially closed. The coal is thus left to burn until "all the gas is out of it," which will require about 1½ hour, when the cover is placed over the mouth to within half an inch on one side in order "to harden the coke" formed. After this, the coked coal is cautiously poked down amongst the pots, care being taken to keep the draught holes open and clear. The cover is now placed to within 1½ inch on one side of the mouth, and the furnace may then be left during 3 hours without a further supply of coal. It is the duty of the foreman to see that the draught holes are properly cleared and the pots kept covered with coke. The heat is gradually raised in the course of the process by removing the cover a little on one side. The process, if properly attended to, will be completed in about 10 hours.

The brass which has been formed is now to be collected. The king-pot is taken out and its contents are well stirred with an iron bar having a flat or paddle-end. One of the side-pots is next taken out and treated in the same manner, when the brass, which has subsided to the bottom, is poured into the king-pot. The other side-pots are taken out in succession, and the same process repeated with

ıe king-pot is well shaken with the stirring-bar during the The brass from all the side-pots having been thus col- he king-pot, the metal in the latter is skimmed and poured ingot moulds. It is scarcely necessary to remark, that as side-pot has been deprived of its brass, it should be re- ıile hot in the furnace. An old calamine brass-maker ıe that good pots lasted on an average 16 days, not being o cool during that period.

nportant in the manufacture of calamine brass, that the ɔceiving pot should always be the cleanest, and have as ɛr adhering to its sides as possible. The paddle is pushed ɑd the sides, so as to get the metal together, which cannot ɪne if there is much concretionary matter round the inside; ently bumping the bottoms of the pots on the floor, the ɘ of the metal is promoted.

lowing details relate to Mr. Pemberton's calamine-brass- merly in operation at Birmingham. The diameter of a ras 3 feet 6 inches at the bottom, and the height 3 feet o the collar. Stourbridge clay crucibles employed, 12 inches 8¼ inches in diameter. Each furnace contained 9 such In later times only two qualities of brass were made, re distinguished by the marks B.I. and B.XX. The ere as follows:—

	B. I.	B. XX.
	lbs.	lbs.
ıered-shot copper	64	61
ıd and sifted calcined calamine from Somersetshire	88	97
	bushel.	bushel.
slack	1	1

Making Calamine-brass in the last Century.—The following :tracted from Mr. Morris's Journals previously referred to, be interesting to brass-makers for the sake of comparison:

RASS HOUSE CALCULATION IN 1781 (AT THE FOREST WORKS.)

	£	s.	d.
Copper shot at ton............	40	10	10
Calamine at £6	4	4	10
charcoal-dust at dozen	0	6	3
oal at 35s. per wey	0	15	4
' week's wages.....	0	15	0
do.	0	12	0
....	0	6	0
aces, tools, grind- ressing calamine, fern, &c.........	0	7	6
	47	17	9
£96 per ton, add	4	14	3
	52	12	0
s is made richer 6 lbs. more cop- charge...........	5	14	4
	£58	6	4

Cr.	cwt.	qrs.	lbs.		£	s.	d
By	14	0	16	Brass at £90 per ton..	63	12	10
			10 lbs.	of do. in skimmings at £45 per ton............	0	4	0
					£63	16	6

The copper is estimated to increase 50 per cent. in weight; and the brass, which is composed of two parts of copper and one of zinc, to be equal to the weight of the calamine used.

THE BRASS HOUSE CALCULATIONS IN 1784.

Dr. cwt. qrs. lbs.	£	s.	d.	Cr. cwt. qrs. lbs.	£	s.	d.
14 2 26 Copper shot at £80 per ton..............	58	18	7	By 22 0 11 Brass at 65s. per cwt......................	71	16	4
22 0 11 Calamine at £5 15s. per ton	6	7	1				
12 bags of charcoal at 30s. per dozen	1	10	0				
¾ wey of coal at 35s. per wey	1	6	3				
Workmen's wages	1	4	0				
Wear of furnaces, tools, grinding and dressing calamine, fern, &c.............	1	3	0				
	70	8	11				
Profit...............	1	7	5				
The furnaces in one week	£71	16	4				

In this process oxide of zinc is reduced at a temperature below the melting-point of copper, which, being thus exposed to the action of the vapour of zinc, becomes permeated with this metal and converted into brass. Care must be taken so to regulate the temperature that the *copper shall not melt*, but remain diffused through the mass of the charge; for if it were allowed to melt, it would trickle down to the bottom of the pot, in a greater or less degree, and much of the zinc would then escape.

By exposure to the vapour of zinc, copper may be converted into brass even below the melting-point of this alloy. In illustration of this fact, the following pretty experiment may readily be made:—A little zinc is placed at the bottom of a clay crucible, and covered with a layer of coarsely-pounded fire-brick or burnt fire-clay; a copper coin is then introduced and surrounded with coarse charcoal-powder; after which the crucible is closed with a luted cover, and exposed during a considerable time to a gentle red-heat. The surface of the coin will by this means be converted into yellow brass, without obliterating the effigy and other characters upon it. In experiments of this kind which we have made, the surface has always had a crystalline or *frosted* appearance.

Calamine-brass was formerly used by button-makers in the manufacture of *gilt buttons*, which were gilt by the old process of *water-gilding*, *i.e.* by means of mercury (*lucus a non*, &c.)—a designation which would be more appropriate to the modern method of electro-plating. It was preferred for this purpose, because it was said to receive the gold better than brass made from spelter; and to "stand the soldering better," to which these buttons were subjected in attaching the shanks. It was also specially used in making the wire-gauze employed in the sieves of papermakers. A thoroughly practised brass-worker in Birmingham most positively maintains to me that he can immediately distinguish calamine-brass from common brass

y the peculiar appearance of its polished surface. Why calamine-brass should differ from common brass, I do not at present understand; but that such difference actually existed when the former kind of brass was largely produced, can hardly be denied. Indeed so impressed are some of the Birmingham brass-founders with the fact of this difference, that quite recently I know one large firm has applied to an establishment in Glamorganshire for calamine-brass. Perhaps the difference between the two kinds of brass would not now be found, if the manufacture of calamine-brass were resumed; and that which formerly existed may have depended upon inferiority in the quality of the zinc produced at that time. Calamine-brass, I believe, ceased to be manufactured in Birmingham because its price was sensibly higher than that of common brass.

I have met with a statement to the effect that a Mr. Champion obtained a patent, about the year 1818, for making brass by exposing plates of copper to the vapour of zinc *below* the melting-point of brass;* but in the Abridgments of Specifications relating to Metals and Alloys, I do not find any record of this patent. It has been supposed that the remarkably malleable brass of Nuremberg was produced by a similar method.

Direct Preparation of Brass.

This is effected either in *crucibles*, as in ordinary brass-foundries, or in *reverberatory furnaces*, as in the manufacture of yellow-metal sheathing. The crucibles employed for this purpose have been previously described. The zinc is gradually and cautiously added to the copper when the latter has *just* melted. The ingots of copper before being put into crucibles, should be heated to redness. The furnaces in use in Birmingham are about 10 inches square and two feet deep, while those which I have seen in London are round. The flue leading to the stack should be *small*, and close to the top of the furnace; but its size must obviously vary with the stack and other conditions. The fuel should be *good* coke, and not such as frequently contains a large quantity of corrosive ash. The metal, when well melted, is skimmed and poured into sand-moulds for castings of various kinds; or, when intended for rolling, into closed iron ingot-moulds, previously warmed, lightly oiled and dusted over with charcoal in the interior. In former times moulds of granite were used for casting ingot-brass. In the making, casting, and remelting of brass, there is always an inevitable loss from the volatilization of zinc, for which a due allowance is made to the founders when they deliver the metal.

The Chinese appear to be unacquainted with the art of rolling brass, and, as substitute, cast it into tolerably thin sheets. I have a specimen of one of these, rather exceeding 1-16th of an inch in thickness, which I received from my friend Harry S. Parkes, so well known in his official capacity in China. It has been analysed in my laboratory by Mr. T. Philipps, and found to have the following composition:—

* Manuels-Roret Alliages Métalliques, Paris, 1839, p. 169.

Copper	56.59
Zinc	38.27
Lead	3.30
Tin	1.08
Iron	1.47
	100.71

Muntz's Metal.—This alloy, and its application "for sheathi bottoms of ships and other such vessels," was the subject of a granted to the late George Frederick Muntz, of Birmingha 1832.* The proportions specially recommended in the specifi are 60 per cent. of copper, and 40 of zinc; but these propo may be varied from 50 up to 63 per cent. of copper, and fr down to 37 per cent. of zinc. Best selected copper and foreig are directed to be used. The metal is cast into ingots and *while hot* into sheets, which, when finished, are "pickled" i phuric acid diluted with water to free them from adherent and afterwards washed in water. In the same year Mr. obtained a second patent for "an improved manufacture of and other the like ships' fastenings."† Precisely the same p tions of copper and zinc are claimed in this patent as in th In 1846 a third patent was granted to Mr. Muntz for the use alloy consisting of 56 per cent. of copper, 43¼ of zinc, and lead.‡ In the specification it is directed that only the purest should be used, and that the alloy is to be cast into ingots, are to be rolled at a red heat, and treated in other respects manner stated in the specification of the first patent. I a aware whether the alloy last described has ever been manufa and applied; but my impression is that it has not; and I therefore, dismiss it from further consideration. I may state have succeeded in rolling brass well, which, on subsequent an was found to contain not less than 8 per cent. of lead.

The theory assigned by Mr. Muntz for the application of hi is, that by exposure to sea-water the zinc is slowly and uni corroded over the entire surface, whereby the attachment of acles, &c., is prevented. Mr. Faraday informed me that in a men of sheathing formed of the alloy in question, which ha been exposed to the action of sea-water, he found no zinc rema Experience, especially of late, has certainly not confirmed the ment concerning *uniformity* of corrosive action, as much modern sheathing is eaten away in holes, notwithstandin declaration of copper smelters that in the manufacture of metal they employed only *best-selected* copper and zinc of th quality!

Muntz's metal, or yellow-metal sheathing, has entirely supe copper-sheathing in the merchant service, though the latter retained in the Navy. Its special advantages are stated to b it keeps the bottoms of ships cleaner and costs considerabl than copper-sheathing.

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* A.D. 1832, October 22. No. 6325. Abridgments of Specifications rel Metals and Alloys.

† A.D. 1832, December 17. No. 6347.

‡ A.D. 1846, October 15. No. 11,410.

It is now generally made in reverberatory furnaces, the zinc being cautiously added to the melted copper. The melted metal is tapped into a vessel lined with clay, out of which it is laded into suitable closed iron ingot-moulds, the interior of which has been lightly oiled and dusted over with charcoal in the usual manner. Just previously to tapping, samples of the alloy are taken out, in the same manner as copper-proofs in the process of refining copper, and cast into small ingots, which are passed through rolls while still hot, and are afterwards broken across, when, if the fracture presents the proper appearance, the metal is tapped out forthwith. The fracture should be close and finely granular; but if it does not present the proper appearance, zinc is thrown into the furnace and well mixed with the alloy, after which the fracture is again examined, and if it is right, lading takes place immediately; but if not, the process of adding zinc and the testing of the fracture must be repeated until the desired quality is attained. The eye of the furnace man requires to be educated for this kind of examination. Although the proper quantities of the two metals may have been put into the furnace in the first instance, yet, from the very nature of a reverberatory furnace, it is impossible to calculate upon the precise amount of zinc which may be volatilized, even in the same furnace at different periods. Hence the necessity of testing, &c., above described. But as the usual charge of a furnace consists of copper, "new scrap," and old yellow sheathing, of which the average composition is not exactly known, it becomes all the more necessary to follow the course above described in order to produce an alloy of the right quality. I am informed by an experienced yellow metal manufacturer, that the proportion of zinc should not exceed 38 per cent.—that if it sensibly exceeds this proportion, the sheathing is apt to become friable—and that if it is sensibly below this proportion, it wears away too rapidly.

The rolled sheets, after final annealing, are immersed in dilute sulphuric acid, scoured on the surface with flannel and sand, and afterwards washed and dried.

I am assured that cast yellow metal nails of the same composition as the sheathing cannot be used for attaching it to the bottom of ships. The copper sheathing in the Navy is attached by nails having the following composition:—

Copper	86.82
Tin	9.30
Zinc	3.88
	100.00

Mr. Muntz, like most successful patentees, had to encounter opposition on the part of certain copper-smelters, and to defend his patent-rights in the Courts of Law. He succeeded in obtaining a signal victory over his opponents, which certainly has not always been the fortune of patentees who have benefited either themselves or the world by their inventions. At the expiration of the patent in the ordinary course of fourteen years, Mr. Muntz applied to the Privy Council for an extension of it, when he admitted, if I remember correctly, that it had yielded him a profit of not less than £68,000. The application was refused. A

few years afterwards, Mr. Muntz died, and his property was sw under £600,000; The manufacture of the alloy is still conduc on a very large scale near Birmingham, by one or more of his so There are but few if any metallurgical patents which have been profitable to the patentee as that of Mr. Muntz. Most of the la copper-smelters are now engaged in the manufacture of Mun metal.

GEOLOGICAL SOCIETY OF LONDON.

At the Meeting of February 26.—Prof. Ramsay, President, in the Cha

George Charlton, Esq., Mining Engineer, Dukinfield, Manchester, Julius Schvarcz, Ph.D., Stuhlweissenburg, Hungary, were elected Fellow

The following communications were read:—

1.—"On the Drift containing Arctic Shells in the neighbourhoo Wolverhampton." By the Rev. W. Lister, F.G.S.

2.—"On a Split Boulder in Little Cumbra, Western Isles." By J Smith, Esq., F.R.S., F.G.S.

The Islands of Great and Little Cumbra have (like the west coast of land) a cliff and terrace, indicating an elevation of about 40 feet abov present level of the sea, and the removal of at least 100 feet of rock (stone and trap); the sea at its present level having worn away the rock t extent of only a small fraction of an inch. The terrace on the Little Cu has been moreover ground down and scratched by ice-action, the striæ p unobliterated under the present sea; and on the terrace lies a split bo such as are known to fall from glaciers, and which the author thinks mus in this case have fallen from an escarpment of ice.

3.—"On the Ice-worn Rocks of Scotland." By T. F. Jamieson, F.G.

The author, first referring to the eroded surface of the rocks beneat Drift-bed in Scotland, proceeded to show that the action of ice, an that of torrents, could produce such markings, as he had observed in th of a mountain-stream in Argyllshire, down which had poured the t caused by the bursting of the reservoirs of the Crinan Canal. He advanced reasons for considering that the erosion of the rocks in Sc was due chiefly to land-ice and not to water-borne ice, bringing forwa markable instances of ice-action on the glens and on the hill-sides at Treig and Glen Spean, where moraines, blocs perches, striæ, roches tonnees, and boulders lifted above the parent-rocks indicate a no direction for the great ice-stream from Loch Treig to the Spean, and th eastern course on one hand up Loch Laggan, and a western, on the down the Spean. Up Glen Roy, the ice had apparently passed nort wardly, over the watershed, towards the Spey. In Knapdale, Argyl similar evidence is obtained of a great ice-stream passing over hill and here falling into the Sound of Jura. The author referred to Rink' Sutherland's observations on the continental ice of Greenland as aff a probable solution of these phenomena; and, objecting to the hypc either of floating ice and of debacles being sufficient to account fc conditions observed, he thought that land-ice, moving from central pla downwards and outwards, has effected the extensive erosions referred to in Scotland and other northern regions, at a time when the land wa much higher level than at present. This must have been followed by a submergence, to account for the stratified and shell-bearing drift-beds.

At the Meeting of March 5, 1862.—Prof. A. C. Ramsay, President, in the Chair. George Ford Copeland, Esq., M.R.C.S., 5 Bay's Hill Villas, Cheltenham; William James Dunsford, Esq., 14 Taviton Street, Gordon Square; Charles Henry Gatty, Esq., F.L.S., Felbridge Park, East Grinstead, Sussex; and A. H. Green, Esq., M.A., Fellow of Caius College, Cambridge, were elected Fellows.

Sir P. G. Egerton, Vice-President, having taken the Chair, the following communication was read:—

"On the Glacial Origin of certain Lakes in Switzerland, Scotland, Sweden, and North America." By A. C. Ramsay, F.R.S., President of the Geological Society.

The author first stated that in this memoir he proposed to extend his theory of the glacial origin of the smaller mountain-lakes of Wales and Switzerland (published in "The Old Glaciers of North Wales") to those greater lakes of Switzerland, which, like the tarns above alluded to, lie in true *rock-basins*. He then explained a map, compiled from those of Charpentier, Morlot, and Mortillet, showing the ancient extension of the great Alpine glaciers across the Lowlands of Switzerland to the Jura, also over the area that surrounds the Lake of Constance, and on the South into the plains of Piedmont and Lombardy. All the great lakes of Switzerland, and the lakes of Como, Lugano, and Maggiore, lie directly in the course of one or other of these great glaciers; and, as shown by the soundings, and the levels of the rocks at their mouths or in the river-beds below, each of these lakes, like the smaller tarns of the Todten See and the lake at the Grimsel, was shown to lie in a true rock-basin. He then considered the question of the denudation of the Alpine and Miocene areas of Switzerland, and showed that none of the lakes lie in *aboriginal undenuded synclinal hollows*. Next that they do not lie in areas of mere watery erosion. Neither running water nor the still water of lakes can scoop large hollow basins like those of the lakes, bounded on all sides by rocks. Running water may fill them up but cannot excavate them. He next contended that they do not lie in lines of gaping fracture. A glance shows this with respect to such lakes as those of Geneva, Neuchatel, and Constance; and, reasoning on the nature of the contortion of the strata of the Alps, he contended that, though fractures of the rocks must be common, they need not be gaping fractures. To produce such a mountain-chain, the strata are not *upheaved and stretched* so as to produce open cracks; on the contrary they are *compressed laterally and crumpled up* into smaller space, and the uppermost strata, that pressed heavily on the crumpled rocks now visible, would prevent the formation of wide open fractures below; these upper strata, as in North Wales, having, over a great part of the area, been mostly or altogether removed by denudation. Next, lakes of the rock-basin kind do not lie each in an area of special subsidence. If so, for instance, we should require one for the Todten See, one for the Grimsel, one for the ancient lake of the Kirchet, several at the foot of the Siedelhorn, many hundreds close together in Sutherlandshire, and thousands in North America.

If, then, the lake-basins were formed by none of the above-named causes, the only other agent that has affected the country on a great scale is glacier ice. All the lakes lie directly in the courses of the ancient glaciers. The basin of the Lake of Geneva is 950 French feet deep near its eastern end, and was scooped out by the great glacier of the Rhone, the ice of which, from data supplied by Charpentier, was, as it issued from the valley, 3550 feet thick to the bottom of the lake. This great weight of ice ground out the hollow of the lake, which gradually shallows towards Geneva, where the glacier thinned and the grinding power was lessened. Where the same glacier abutted on the Jura, the ice-current was arrested, and it flowed to the N E. and S.W.; and where the ice was thickest and heaviest above the Lake of Neuchatel, it ground out the hollow in which the lake lies.

The lakes of Thun and Brienz lie in the course of the great Aar glacier those of Zug and the Four Cantons in that of Altorf; the Lake of Zurich lies in that of the Linth, the Lake of Constance in the course of the prodigious glacier of the Rhine Valleys, the numerous little rock-basin lakes near Ivrea in the line of the glacier of the Val d'Aosta, and those of Maggiore, Lugano, and Como in the courses of the two gigantic glacier-areas that drained the mountains between Monte Rosa and the Sondrio.

The sizes of the lakes and their depths were then shown to be, in several cases, proportional to the magnitude of the glaciers that ground out the basins in which they lie, and the circumstance as to whether the pressure of ice was broadly diffused, or vertical as in narrow valleys.

Finally, it was shown that rock-basins holding lakes are always exceedingly numerous in and characteristic of *all countries that have been extensively glaciated*. Lakes are comparatively few in the southern half of North America, but immediately south and north of the great lakes and the St. Lawrence, the whole country is *moutonnée* and striated, and also covered with a prodigious number of rock-basins holding water. The same is the case in the North of Scotland, the whole area of which has been *moulded by ice;* and east of the Scandinavian chain, in another intensely glaciated region, the country is covered by innumerable lakes.

MEMOIRS OF THE GEOLOGICAL SURVEY.

The Geology of the Neighbourhood of Edinburgh. By H. H. Howell, F.G.S., and Archibald Geikie, F.R.S.E., F.G.S. — Appendix and Lists of Fossils by J. W. Salter, F.G.S.—London: Longmans.

The Geology of Parts of Berkshire and Hampshire. By Henry W. Bristow, F.G.S., Geologist, and William Whitaker, B.A., F.G.S., Assistant Geologist.—List of Fossils by Robert Etheridge, F.R.S.E., F.G.S.—London: Longmans.

The first of these Memoirs—Geology of the Neighbourhood of Edinburgh—is one of the most valuable that has yet been issued by the Survey. It comprises the district lying on either of the sides of the Pentland Hills, including measures ranging from the Lower Silurian to Upper Carboniferous, largely penetrated by eruptive rocks—a country presenting an extraordinary amount of interest within a comparatively narrow compass.

e country on the east side of the hills is a broad plain, consisting irely of Carboniferous strata, extending southward until they abut inst the Lower Silurians of the Moorfoot and Peeblesshire hills. These m a synclinal trough, in the centre of which is the Mid Lothian basin coal-bearing strata, the probable equivalents of the lower part of the glish coal measures; between this centre and the outer edges is another of coal-bearing strata, surmounted and underlaid by marine limestones, whole forming the equivalent, partly terrestrial, partly marine, of the rboniferous limestone of England. Along the western edge of this in the strata recline at a very high angle, sometimes even vertical, and e lower series of coals have hence been called "Edge coals," in contra-stinction to the upper series or "Flat coals," which lies more or less risontally in the middle of the trough.

This Mid-Lothian coal-field is divided by the authors of this Memoir to the three following subdivisions:—

1. The Carboniferous Limestone Series, with its associated beds of rine limestone, coal, ironstone, fireclay, sandstone, and shale.

2. The Millstone Grit, consisting principally of coarse red and white ndstone and conglomerate.

3. The Coal-measures, which lie in the centre of the basin, the equiva-lt of the Coal-measure strata in the Midland and South-western counties England, and in Wales, and which here include two series of coal-beds, erstratified with strata of sandstone, fireclay, clay-ironstone, and ile.

n every respect this Memoir, which is illustrated by a coloured Index logical Map of the district, and by numerous wood-cuts, will be found thy of an attentive study. The chapters on the Intrusive Igneous ks of the district, and on the Faults, will be found peculiarly in-ctive.

he Memoir of Messrs. Bristow and Whitaker is on a district of less king general interest, but it is nevertheless full of information to the logist, and is remarkable for the clearness and neatness of its style. eed, all the recent productions of the Survey are highly commendable his respect, and should be taken as an example by some other Geolo-s, who still seem to imagine that they add importance and dignity to ir productions by producing them in a ponderous and involved e.

ROCKS AT THE MUSEUM OF IRISH INDUSTRY.

natory Catalogue of the Specimens illustrating the Composition, Structure, nd other Characters of the Irish, British, and Foreign Rocks, in the ollection of the Museum of Irish Industry, Dublin.

r great branch of the science of Geology, which Mr. Jukes, in his nual of Geology, defines as GEOGNOSY, is the portion of real import-e for industrial purposes. It includes the mineral composition and cture of rocks (Lithology), and their physical relations, excluding all tions of age (Petrology). To Mr. Jukes, the author of this catalogue, t be given the credit of having first, in this country at least, given due minence to this branch of Geology. Admitting the paramount im-

portance of paleontology, and the arrangement of strata in a chronologi series, it cannot be denied that Geology has been prejudiced in the mind practical miners, by a too exclusive devotion to these subjects. It is, course, ridiculous to rail at collections of "shells;" but still it is natu that a man who knows nothing of paleontology should be impati of that exclusive devotion to it, which alone for many years passed f Geology. When Geologists turn their active attention to Lithology a Petrology—that is, the respective mineral composition and structure rocks, and their physical relations on a large scale—we are satisfied th will find no more zealous nor abler coadjutors than the class of practi miners.

The present catalogue, drawn up, as we have stated, by Mr. Jukes, is valuable evidence of the attention which the subject is now receiving. consists of two parts—the first, a catalogue of rocks collected chie in Ireland, with only a few specimens from other localities for comparis —and the second, a catalogue of typical European rocks, chiefly erupti and metamorphic, purchased from Dr. Kranz. The collection, on t whole, must be a very valuable one, and well worthy of the attention any one visiting Dublin. The catalogue itself will be found valua for reference.

Revue Universelle des Mines, de la Métallurgie, des Travaux Publics, Sciences et des Arts appliqués a l'Industrie. Sous la Direction de Ch. de Cuyper, Professeur des Sciences de l'Université de Li Inspecteur des Études a l' Ecole des Arts et Manufactures, et des Mi 6th year, 1st livraison, January and February, 1862.—Paris et Li E. Noblet.

This very valuable periodical, which appears every two months, see scarcely inferior in the character of its articles to the *Annales des Mi* The principal articles in the present number are On the Iron Work South Wales, by M. E. Rollin; On the Salt Mines and Works of St. Nico Varangeville, by M. L. Bronne; On the relation between the increase of surface heated and the increase of the quantity of water evaporated; On Machines for sawing soft rocks used in the quarries of Pyrimont (Sav by M. M. A. Lebrun and Ch. Demanet; On the patented Improvement the Treatment of Iron-ores in Blast Furnaces, by M.M. Eugène Boulan and Jules Dulait; and on the Spectrum Analysis, by Fr. Dewalq There are besides numerous abstracts from other periodicals, and the wh is illustrated by numerous first-class plates.

UNDERGROUND MINERAL TRANSIT.

On Underground Mineral Transit. By Mr. James Ferguson. *Ex Minutes of Proceedings of the Meeting of the Institution of Engineer Scotland, 3rd April,* 1861. Glasgow: William Mackenzie, Howard-str

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A short time ago a paper on "Underground Mineral Transit" contributed to the "Transactions of the Scottish Institution of Enginee at the request of the President, by Mr. James Ferguson. The writer nounces at the outset that it is not his intention to give a complete hist of the subject, but merely to allude in a general way to several of

modes of underground transit now in successful operation; and he also limits his remarks almost entirely to what has come under his own observation.

Before entering upon any details of the subject, Mr. Ferguson makes reference to the numerous and peculiar difficulties intimately connected with all kinds of underground mineral transit, and adverts to

(1.) The various angles of inclination which mineral beds and mineral veins are found to exhibit, and at which they are worked—from a dead level, or undulated plane, upwards through every degree of inclination to the vertical.

(2.) The "breaks," "shifts," "hitches," or dislocations to which all mineral deposits have been subjected—met with in all mining operations—whereby the bearing and inclination of the strata may be at once so much disturbed as to necessitate an entire change in the direction of the roads.

(3.) The direction and gradients of underground roads as further influenced, and in some measure determined by the course of the "backs, cracks," &c. These, in sedimentary rocks, are natural vertical divisions of the strata, which must be attended to in mining as a matter involving the safety of the workman, and also the economy of the mine.

(4) The characteristics of the rocks forming the roof and pavement of the mine, which may be such as to preclude the formation of an economic drawing road. This may arise from two totally different causes:—The concomitant beds may be so very soft, or friable, that for safety they must be secured by timbering; or so very hard, that the construction of a proper road would cost more than the amount of benefit which it would yield.

(5.) The very small amount of daily traffic which the great number of the roads in any mine require to accommodate, even when the aggregate produce of the mine is very great.

Mr. Ferguson next gives a sketch of the commencement and progress of underground mineral transit.

1. Bearing System.—This system was in operation at the collieries on the "Edge" seams of coal, to the east of Edinburgh, so late as the year 1831—the only time and place where the writer had an opportunity of seeing it. The bearing system is said to have been peculiar to Scotland. Whether this statement is correct or otherwise, there is little doubt as to its having prevailed there from time immemorial up to the passing of Lord Ashley's Bill in 1843, whereby all women and boys under ten years of age were excluded from working underground. It is probable that the system had its origin in the "Edge" seams alluded to, and was confined chiefly to that locality, as there are no records of it in the west of Scotland. This mode of transit, if not the earliest, is certainly one of the rudest that can be imagined. Boys, young women, and mothers were usually employed at the beastly labour, the mode of carrying the load being precisely the same as that followed by the Newhaven fish wives at the present day. All the plant necessary for conveying minerals underground by this system was a basket or creel, capable of containing from 1½ cwt. to 2 cwt. of coals, and a strap or broad belt of sufficient length to pass from one side of the creel to the other, and round the forehead of the bearer, when the creel was upon her back; and these the bearer had to provide. In this manner was the coal taken in back loads from the place

where it was dug to the surface of the mine. At first this would l by means of "in-going eyes" or roads from the "out-crop" of the latterly pits were sunk, and the load was carried not only along t of the mine, but also up the pit to the surface by means of ladders o and in some cases these stairs were cut in the sides of the shaft like screw. This latter portion of the labour was early displaced by t and windlass, horse-gins, water power, and the other modes of loads vertically. When the coals, "water-free," became exhaust the seams were drained by shafts sunk down under the level of the adit, the usual method was to sink a shaft midway between the and the lowest portion of the breast of coal which had to be worl To this intermediate shaft all the coals drained were carried dov the upper section, and up from the lower section, to the pit's botto the bottom of the pit the creels were emptied into round tubs, bas boxes of sufficient size to contain two or more back loads, and from were taken by the winding engine to the pit bank. The first step t improve this system was the introduction of rails, and the conve the large baskets or tubs, upon a truck, along the level roads to a where the bearers were sooner relieved of their load. Mr. Dunn, the Government inspectors of mines, in his work on the "Ori Progress of Coal Mines," states that the load carried by the bea from 200 to 240 pounds, and the distance which it was conve about 2,800 yards per day; in other words, forty loads per day c distance of seventy yards. For performing this labour the bea paid from 1*s*. to 1*s*. 2*d*. per day. The following statement, wh been obtained for the purpose of preparing this paper, is so different from that published by Mr. Dunn, and corresponds with published by Mr. Bald, in 1812:—

1. Average distance carried .... 400 yards.
2. „ weight per load .... 1½ cwt.
3. „ number of loads per day 24

Which, calculated at 1*s*. 2*d*. per day, gives 34·1*d*. as the rate per ton j for cost of conveyance. Whilst in this statement the details of la different, the rate of remuneration is the same as given by Mr. namely, 1*s*. 2*d*. per day, when colliers were being paid at the rate o 2*s*. 6*d*. per day. Mr. Bald, mining engineer, Alloa, the worthy f the profession in Scotland, in a work entitled "Inquiry into the the Women who carry Coals underground in Scotland, known name of *Bearers*," published in 1812, says that—carrying 1½ cw load—the daily labour performed for five days each week was—

On the level at the pit bank .... 480 yai

On a rise of 1 in 12 feet, that is, a rising gradient at the rate of a little more than 146 yards per mile . 3,600 ,

The vertical distance being .... 936 ,

Mr. Bald adds, the wages paid for this work was *eightpence* p Another statement is given which, as well as the above, came un Bald's personal observation, in which a load of ¾ cwt. was convey yards, with a perpendicular rise of 700 yards, as a woman's daily w distance passed over with the load being at the rate of 38·9*d*. for ance per ton per mile. The bearer, in addition to the labour of c a load at the rate of 38·9*d*. per ton per mile, raised 5 cwt. to the h 200 yards, being one-fourth of a day's work for an able-bodied m

an article which he contributed to Brewster's "Edinburgh Encyclopædia," published in 1830, he says, "The weight the women carry is from 1½ to 2 cwt., and in some cases they have been known to carry 3 cwt. At several collieries in Scotland 60,000 tons a-year have been carried in this way." The writer has alluded to the mode of bearing under its most favourable aspect; that is, when there was sufficient space to carry the back load in the easiest manner for a human being; but the wicked abuse did not stop short at this stage of degradation for the bearer. Being reduced into a system, it was introduced into the thin coal seams also, where the body had to be bent downwards and distorted whilst the heavy load was put upon it, the poor bearer performing the task in a manner disgusting even to think about. The following description of how a load was carried in these thin coal seams is from the mouth of one who in her youth had been so employed:—"The creel was first filled, and whilst the bearer was stooping and bending forward the loop or bight of the strap fixed to the creel was passed over her back and forehead, and thereby was the load sustained, the length of the strap being so adjusted as to allow the creel to hang down behind over the body, partly resting upon it, but only kept from falling by the strap pressing against the forehead." In such a position as we have attempted to describe, with the highest part of the back and the top of the load nearly on the same level, the head and shoulders of the bearer were necessarily still further depressed. An addition to the load was now made by placing a block of coal upon the neck between the shoulders, whereby the muscular action operating to keep the head down was materially assisted, and the tendency of the overhanging load to draw the head upwards was in a certain degree met and provided against; or, as our informant stated, "it helped to balance the creel." Whatever evils yet linger amongst us of this sort, that one is now gone for ever, and with it several curious incidents of social life which it engendered. The supply of bearers being limited almost entirely to those who had been trained to the labour from early youth, there was a constant demand for them; and a stout lass who could carry a few pounds more than her neighbours could *choose* her husband from the young colliers of the mine. It is also told that upon those interesting occasions, which are from their nature peculiarly feminine, the husband rested until his wife was able to resume her share of the underground toil.

II. Sledge System.—The first step taken to lessen the labour of underground transit by the application of mechanical skill, was the introduction of the sledge or "slipe-hutch"—the name given to any kind of box, with cradle feet, used for conveying mineral underground. The sledges were drawn along the natural floor of the mine by men, women, and boys; and where animal power could be profitably applied, that power was also made use of. The sledges were shod with iron, and contained from 1¼ to 5 cwt., according to the inclination of the road, the nature of the pavement, and the motive power. Where the pavement or floor of the mine was soft, slabs from round trees, wattles, and other such things were laid down across the line of road to reduce the friction. The harness used for this kind of work, when manual labour was applied, consisted of two straps passing over the shoulders, their ends being connected with a chain to which the load could be attached. On a well-kept road, with a rise of about 1 in 8, the labour of dragging a gross load of 7½ to 8½ cwt. downwards, is nearly the same as the taking of an empty hutch in the upward direction, the weight of the empty hutch being from 2 to 2½ cwt. On a level road it requires the utmost exertion of an able-bodied man to drag a gross load of 8 cwt., and the labour cannot be maintained for any considerable distance at one

time. This mode of transit upon a level road is most laborious and exhausting, involving a continuous dead pull, where not a single inch of ground can be passed over without a corresponding effort. When engaged in it the drawer may be seen stretched forward nearly into a horizontal position, his hands clutching at the pavement, or pressing against the sides of the passage, to aid his slow progress, every muscle as rigid as iron, and strained to the utmost. The sledge mode of transit was the only one in use at a considerable colliery in Scotland within the last 15 years, and as the labour of drawing the coals was performed by contract, and perfectly unconnected with the labour of digging them, a correct idea is obtained of the cost of conveyance by this system. The quantity conveyed in the hutch or sledge at one time was little more than 1¼ cwt., *less*, it may be noticed, than the weight which the collier put upon his daughter or wife for a back load. Without going into the reason why such light loads were drawn, we shall at once state that, for the drawing of 20 score—21 being considered a score—that is, for the drawing of 420 of these light loads the distance of 60 yards, the sum of 8*s*. 4*d*. was paid, and also that these 420 loads only weighed 26 tons 5 cwt. For every additional 24 yards which the 26 tons 5 cwt. was conveyed, the sum of 4*s*. 2*d*. was paid. Thus, with wages at about 2*s*. 6*d*. a day, we have—

1. Rate per ton per mile when conveyed a distance of sixty yards .... 9*s*. 3½*d*.

2. Rate per ton per mile when carried a distance of eighty-four yards .... 9*s*. 11¼*d*.

At Auchinheath Colliery, about thirty years ago, the system in operation was a combination of sledge work and railway. The flat long boxes weighed about 2¼ cwt., and when carefully filled carried a load of 5¼ cwt. The price paid for drawing 300 yards, or thereby, upon the level railway, with 100 yards of sledge work to the rise of the level, was one shilling per ton, or about 3*s*. 8½*d*. per ton per mile, wages being 4*s*. per day. The increased remuneration for sledge work was at the rate of fourpence per ton per 100 yards, or at the rate of 5*s*. 10*d*. per ton per mile.

Horse Sledges.—Horses, mules, &c., were from an early period made use of in coal mines to drag the sledges instead of men. The horse sledges contained from 5 to 6 cwt., and were sent direct from the working faces up the shaft to the pit-bank, as filled by the colliers. This was a step in the proper direction, animal labour being substituted for severe manual toil, and refilling was dispensed with. Being without details of the cost of sledging by horses, it is only from general recollection the writer states that he is satisfied that this mode of transit was by no means an economical one; and of all the kinds of labour to which horse power has ever been applied, underground sledge work was one of the most wasteful and cruel. The drawing chains of the horses' harness being attached direct to the ends of the cradle foot of the sledge, jolted from one side to the other, as it proceeded along the uneven track, striking against the pillars; or as it was hurriedly conveyed down the rugged inclines, the horse was tugged and twisted in every direction, and cut and bruised in every possible manner—now lashed forward to keep clear of the descending sledge, and the next moment straining to take it onward over some newly-fallen portion of the roof—first one drawing chain and then the other having all the strain upon it, as the load was shifted from one galled shoulder to the other, in taking the dark angular passages of the mine. The drivers were usually boys, all tasked to a certain number of "raiks" per day, each striving to outstrip his neighbour, if by lashing and reckless driving he could possibly do it.

SLEDGE AND RAIL.—The first step towards improvement upon the sledge system, as in the case of "bearing," was the introduction of rails upon the level roads, a low-wheeled truck being used to carry the sledge or box containing the load. The men or horses, as before, dragged the sledges from the working faces to a station upon the main road, where a bench, the same height as the truck, gave facility for placing the loaded sledge upon it. The gauges of the early underground-railways were exceedingly narrow (in some cases not more than fifteen inches), and, on account of this circumstance, it is presumed, men were at first employed to push the wheeled truck, with the loaded sledge upon it, from the station to the bottom of the shaft. As the advantages of railways were very soon seen, the introduction of a wider gauge, and a horse to drag a train of loaded trucks, naturally followed. In addition to this, the railways were extended from the stations on the main roads into each of the working faces, the sledge work being restricted to the rise workings, where, from the steepness, a truck with the sledge upon it could not be taken. The use of sledges is now entirely confined to mines where the inclination of the strata is more than one in six, and in very few cases are the sledges sent up the shaft to the bank, as was done until very recently almost every where. Where the inclination of the sledge-track approaches the angle of forty degrees, the drawer finds it to be less laborious to carry the sledge upon his back than to drag it behind him up the steep incline. In such cases two sledges are sometimes used in each of the working faces, with a chain and pulley, whereby the empty sledge is dragged up the incline by the full one, the drawer guiding the full one in the descent. The chain and pulley are fixed to a tree, which is jammed hard up between the roof and pavement, and is removed upwards from time to time as the working face advances.

III. BARROW SYSTEM.—Previous to the introduction of four-wheeled trucks and rails, wheelbarrows were partially in use as an improvement upon the sledge. "The inconvenience felt in the transfer of the coals from the barrow to the tub or basket in which they were to be drawn up the shaft," says Mr. Dunn, "originated the tram, with wooden wheels, upon which the coals could be conveyed in a tub or basket from the working faces to the top of the pit without transfer. The barrow-ways suitable for the tram consisted of three planks, the upper one forming the guide for the tram-wheels.

IV. RAILWAYS AS NOW CHIEFLY USED UNDERGROUND IN SCOTLAND.—It is foreign to the object of this paper to attempt giving a history of the many rude appliances which were the prelude to the railway of the present day. Wooden rails and sleepers were introduced in the north of England between 1632 and 1649. In 1676 they are described as being made by laying rails of timber from the colliery to the river, exactly straight and parallel. Within the last twenty years, railways, formed with hard-wood timber alone, or of timber covered with thin bars of iron, were to be met with at many of the small collieries in Scotland, and also the carriage with its timber axle and wheels. The first certain account of cast-iron being used for rails is met with in the books of Colebrooke Dale Iron Company. From these it appears that on the 14th November 1767 between five and six tons were cast as an experiment, under the superintendence of Mr. Curr. Mr. Curr, in his *Coal Viewer and Engine Builder*, published in 1797, claims to have invented and introduced cast-iron tramways, or plate rails, at the Sheffield Colliery in the year 1777, that is, twelve years after the experiments made by him at Colebrooke Dale, in Shropshire. The earliest notice which we have of malleable iron being used for rails is at Walbottle Colliery, near Newcastle-upon-Tyne, partially laid down as early as 1794, and completed by Mr. C. Nixon in 1805. John Neilson, of Oakbank, near Glasgow, laid the first malleable-iron rails in Scotland at Hurlet, about the year 1818. The general introduction of railways underground did not at first very much modify the arrangements

for collecting and conveying the produce of the mine. The low-wheeled truck was long retained, with the basket tub, or sledge, placed upon it, containing the load; and where horses were employed, two or more loads were placed upon one truck, being lifted from the small truck and placed upon the large one by means of a small crane. The inconvenience of this method is evident; and it is again to Mr. Curr, of Sheffield Colliery, that we are indebted for the next step in the way of improvement by the introduction of wheeled carriages as now used,—a most decided improvement upon the truck with the detached basket or tub containing the load. Previous to the wheeled carriages being sent up the shaft, an arrangement had to be made to prevent breakage, and at first they were guided by conductors of iron, stretched from the pit-head framing to the bottom of it, and made as tight as practicable. These conductors, formed of iron bars, united by means of links or screws, have been used in some of the English collieries from the time of their first introduction until the present day; and such conductors are still partially made use of, with wire ropes substituted for the bars of iron. The invention of the cage was necessary to perfect the plan of taking the loaded wheel carriages up the shaft, and by it this can now be done at any speed with the utmost safety. These cages or platforms may be made to contain any number of wheeled carriages, and are made to carry from one to eight at a time. They are permanently attached to the winding ropes, and kept in their position by perpendicular wooden guides, fixed to the sides of the pit. The cage and guides first introduced into Scotland about twenty years ago are now almost universally used along with the wheeled carriages, for conveying the load direct from the working faces to the pit-bank. It does seem strange why the fixed wooden guide was not first discovered, being at once the best, the simplest, and the cheapest. While the guides or conductors have been improved, our underground rails and railways throughout three-fourths of the Scottish mines are very much what they were when first made by Mr. Curr about sevent years ago. The cast-iron sleepers introduced by Mr. Curr have been fo a long time abandoned; in other respects they are precisely the same. Th reason why so little attention has been paid to so important a matter ma be found in the fact that hitherto the greater number of the pits in Scotlan have been so easily sunk that it was more profitable to sink a new than t make and maintain an extended system of good roads from an old one and this the more from the irregularity and disturbed character of th mineral fields in Scotland rendering any uniform plan of working an utt impossibility. With few exceptions, cast-iron plate rails and woode sleepers are used in the railways of the mines in Scotland. These rai weigh from 50 to 60 lbs. per lineal yard of railway, and cost just now abo 85*s.* per ton; and including sleepers, nails, and laying down, the mile railway costs only about £220. From the difference of weight in the rail when malleable iron is used, the cost per mile is nearly the same. Th gross weight carried upon these rails is seldom more than 10 cwt., and eve with that load the breakage of cast-iron rails is very considerable. Th carriages used in the coal-mines of Lanarkshire weigh from 2 to 2½ cwt and are calculated to contain 4½ cwt. of riddled coals, free from dust an small coals, or about 6 cwt. of useful load. Wheels are used both of malleable and cast iron, and vary in diameter from 8 to 12 inches, being sometimes fixed to the axle, and at other times loose upon it. In many plac the drawing of coals, as well as the getting of them, is performed by th collier, and in such cases there is some difficulty in ascertaining the actu cost of conveyance; in others the drawing of the coals is performed by m specially employed for that purpose, with horses to convey the truc along the level roads and up inclines, where, from any unavoidable caus these are necessary in the operations of the mine.

The following particulars are the result of inquiries made regarding th cost of conveyance in some of the collieries in the Monkland district, whe

ire employed, and no horses introduced:—1. In pits where the e nearly horizontal, the distance travelled per day with the load is from 4000 to 6000 yards, and the cost per ton per mile from 2d. 2. In pits with the metals inclined upwards, with a rise of 1 6, or an angle of 10°, the distance travelled with the load of r day is from 3000 to 5500 yards, the cost per ton per mile rom 2s. 4d. to 4s. The difference in this case may arise from the ngth of rise roads. 3. In pits where the drawing of the load is and where, from other local causes, the roads have to be laid off gradients, the distance travelled with the usual load per day om 1250 to 3000 yards, and the cost per ton per mile is from

lowing particulars are from collieries on the Lesmahagow line of stablished within the last few years, where the drawing is a com- of manual and horse labour:—1. Distance travelled with the load oads, 170 yards; distance travelled on level roads, 220; total, . Average cost per ton per mile, 1s. $3\frac{1}{2}d$. 2. Distance travelled load on rise roads, 250 yards; distance travelled on level roads, l, 624 yards. Average cost per ton per mile, 1s. 7d.

hinheath and Craignethan gas-coal works, in the parish of Lesma- n attempt has been made to improve upon the system of under- ansit as now at work in the west of Scotland. The carriages used 9 inches long by 3 feet wide inside, and 8 inches deep, and weigh, r and dry, 4 cwt. 1 qr. 14 lbs., with 12-inch cast-iron wheels for . The average load of coals, taken from the weigher's book at nouth, is 13 cwt. In drawing ironstone or refuse the average about 17 cwt., although a load of 20 cwt. is sometimes put into as and sent up the shaft. Common malleable-iron bars are used 2 inches by $\frac{5}{8}$ths on the rise roads, and 2 inches broad by $\frac{3}{4}$ths the more permanent level roads, being notched into the interme- pers, with cast-iron chairs at the joinings. The cost of a mile of £300. In laying the bars, the joinings of opposite rails are never the same sleeper. Some time previous to the introduction of horse out eighteen months ago, a careful account was taken of the work d and the cost of it. The average length of the level roads was , the shortest being 120 yards, and the longest 611. The average the rise roads was 118 yards, the shortest being 12 yards, and the 3. The greatest distance travelled by a "drawer" per day, taking ge of a fortnight's labour, was 9 miles 91 yards; the general aver- vel was between six and seven miles, this including going out oad and returning with the empty wagon; but it must be noticed ushing of the empty wagons up the rise roads was the most severe the labour performed. At the time when the cost was calculated, oyment of a boy to assist the "drawers" up the rise roads had lmost universal, and the price paid for drawing was 4s. per day and 2s. per day to a boy for one load. The writer is satisfied that se the distance was exceeded at which, under the circumstances, bour should have been employed, the number of "drawers" upon ngth of road causing much time to be lost in waiting upon each ilst on the level roads a boy was not required, although the labour me too severe for one man to perform the usual and requisite f journeys. The cost per ton per mile varied from 2s. to 3s. 8d, day for the drawing of one load, or at the rate of from 1s. 4d. to 6d. per ton per mile when 4s. per day was paid. Horses are now d, whereby all the labour of drawing is performed, with the ex- f taking the loaded wagon from the working face to the foot of oads. Previous to giving the details of cost, it may be noticed system is at work where the arrangements of the mine were not prepared for it, and it is already seen where several improvements

to lessen cost can be introduced. Considering that remarks on a matter so local are unsuited for a paper such as this, the details of the system are given precisely as they are now in operation, with the labourers' wages at from 3*s*. 6*d*. to 4*s*. per day. 1. Labour performed by men—taking the loaded wagons from the working faces to the foot of rise roads, and walking back the distance the load is conveyed, is paid at the rate of 1·5*d*. per ton, or 16·6*d*. per ton per mile. 2. Labour performed by ponies, that is, taking the wagons up the rise roads and returning the same distance without any load, say with turnings 7 miles per day, now costs at the rate of 2·5*d*. per ton, or 2·3*d*. per ton per mile. 3. Incline work, 1·6*d*. per ton, or 8·7*d*. per ton per mile. 4. Train horse with driver, &c., travelling from twelve to fourteen miles per day, 8*d*. per ton, or 2·6*d*. per ton per mile. The total cost per ton by horse labour is 6·4*d*. per ton, or at the rate of 1*s*. 1¼*d*. per ton per mile, the average length of roads being taken at 836 yards. The average cost of manual labour previous to the change was 9·6*d*. per ton, or at the rate of 2*s*. 10½*d*. per ton per mile; but at that time the distance conveyed was considerably less, being only an average one of 494 yards.

The following particulars are from the Coltness Iron Company's Pits, Wishaw district:

Pit No. I.—Output for 4 weeks, 4934 tons.

	£	s.	d.
Cost of transit:—Horses (5 at 3*s*. each per day), 24 at 15*s*. =	£18	0	0
Bottomers	6	14	4
Roadsmen	8	8	0
Ostler	3	12	0
Drawers	55	5	10
	£92	0	2

					Per ton per mile.
49 men draw 400 yards, 2912 tons, cost	£54	6	2	=	12·64*d*.
34 „ 800 „ 2022 „	37	14	0		9·84*d*.
Average					11·24*d*.

Pit No. 2.—Output for 4 weeks, 5687 tons.

	£	s.	d.
Cost of transit:—Horses (5 at 3*s*. each per day), 24 at 15*s*.	£18	0	0
Bottomers	7	12	0
Drawers	31	19	5
Drivers	8	16	0
Roadsmen	12	18	6
	£79	5	11

					Per ton per mile.
45 men draw 300 yards, 2641 tons, cost	£36	16	6	=	19·63*d*.
52 „ 650 „ 3046 „	42	9	5		9·06*d*.
Average					14·34*d*.

The following particulars are from the Staffordshire district, where "skips" are used, and are taken from a certain pit, which is considered to present a fair example of the cost of haulage. The *data* for the calculation are 7288 skips, weighing 345 tons 12 cwt., conveyed the distance of 645 yards; that is, the average distance of the working faces from the bottom of the pit, at a cost of—

	£	s.	d.
18 Horses, at 6*s*. 6*d*. =	£5	17	0
18 Drivers, at 2*s*.	1	16	0
Roadsmen	0	4	0
Horse-fettler or groom, &c.	0	3	6
Cager or hanger-on	0	3	6
	£8	4	0

This makes the cost per ton per mile 15·55*d*.

ter has already alluded to the numerous and peculiar difficulties connected with all kinds of underground mineral transit; and ıy be attributed the slow progress of improvement, the light loads and, generally, the high cost of conveyance per ton per mile, as with railway-carriage above ground. One of the difficulties—e chief one—is the utter impossibility of maintaining uniformity ;; and the practical result of this want of uniformity is evident, ıving to be regulated by the steepest part of the road over which conveyed, and in most cases this difference being very consider- have said the load has to be regulated by the steepest part of and this is the case, whether as regards the pushing of the load r the lowering of it down, when the inclination is more than 1 in load from 6 to 8¼ cwts. gross. When an arrangement can be oncentrate a number of rise roads into one, a self-acting incline, y a brake, is a usual and approved mode of lowering coals, where hutches in descending on one line of rails take up the empty ones ıer line. A similar arrangement of roads, with motive power at he incline, may be used when the load has to be taken upwards. gradient is such that the descending empty carriages "overhaul" ne line of rails will be found sufficient for a very large output, if ith the necessary motive power. Where the inclination is less, npty hutches descending do not "overhaul" the rope, a double ı is again necessary, or some other application of a "tail-rope" empty carriages and the drawing-rope to the lowest part of the new load. Or the rope may be worked over pulleys at the top ı of the incline with a slow continuous motion, the ascending iages being upon one line of rails and the empty descending ones ther, arrangements being made for attaching and detaching at when necessary. Where the natural mode of working a bed of dmit of the working faces being carried on parallel to the main or nearly so, a self-acting incline, with an endless rope, to which carriages could be attached, and from which the empty ones could t any place upon the incline, would be an economic and novel (so far as the writer knows) of this mode of transit—this plan ested by the description of drawing loads upward in a similar

nples of what can be done underground under favourable circum- ı regards the extent and regularity of the coal-field, we can s. iii. and v. of the *Transactions of the North of England Institu- ing Engineers.* It is there stated that engine planes have been a length of 2519 yards, or nearly one and a half miles; and 106 containing 8 cwt. 2 qrs. 8lbs. of coals, and weighing 482 lbs., or ight of nearly 13 cwt., were conveyed in one train at a rate of l to nine miles per hour upon an incline of one in five. In the nes will be found a paper by Nicholas Wood on a plan of work- lds entirely by a system of self-acting and engine-worked in-

nanual and horse power, steam power, compressed air, and water and are used for driving winding machines underground. At ' Auckland Colliery, Durham, steam is conveyed first down a ut 150 yards deep, and from the bottom of the shaft down an ifteen degrees a distance of 1100 yards, making a total distance ·ds. From the result of this experiment it appears that a pres- lbs. per square inch is required to force steam at the rate of 64·5 cond through 1250 yards of 5-inch pipes, and that the loss by d condensation under such circumstances is 80 per cent, the ing reduced from 40 lbs. to 8 lbs. per square inch. Mr. Wood o practical results from steam of 35 lbs. per square inch pressure, .012 yards through 4-inch pipes. Compressed air is used as a

motive power at Govan Colliery, near Glasgow. The steam-engine use for compressing the air is at the pit bank; the compressed air is carrie down the shaft 92 yards, and from thence to the place where it is used, distance of 706 yards. A paper upon this engine, by Mr. Charles Randolph Glasgow, was read at the Glasgow meeting of the Institution of Mechanica Engineers, in September 1856.

Where there is surplus pumping power, water with a high pressure ma be taken from the engine pump, conveyed along the passages of a mine and used as a motive power for winding with any kind of suitable machine

For working out a detached area of coal—where the cost of sinking a pi from the surface would be more than the profit on the quantity which i contains, and where, from any cause, the introduction of steam or any othe motive power would also be too expensive—a wire rope may be passe down a bore from the surface to the place where the lifting power is re quired, being worked by steam or any other available means.

The writer has introduced these observations on motive power to show that where the object in view is of sufficient importance to demand an effor from the inventive faculty of the engineer, the necessary mechanical appli ances are not wanting. What we most require, however, is a simple, safe and expeditious mode of working inclines at a high angle, say with a rise a the rate of 1 in 1¼ or 1 in 2, and that with loads of from 15 to 20 cwt. under the control of one man. Such a machine, to be really useful, should be of such a description that it could be applied to the working-roads a these were cut forward, and also to any place upon a road where, in conse quence of "hitches," or any other cause, a steep gradient had been intro duced. There are many ways, perhaps, in which this can be done, but none has yet been discovered sufficiently cheap and simple to warrant its uni versal adoption, from its merit being clearly seen and felt, as in the case o Mr. Curr's rails and wheeled carriages. Self-acting inclines are the neares things we have that are available, and might be used advantageously to a much greater extent than they now are, notwithstanding the cost of the drum, &c., or the still more simple arrangement of a single pulley—the fixed retarding force being a certain number of the wheels made fast, whilst the man going along with the loaded hutch holds back or pushes forward as may be required, to keep up a uniform motion. The writer has tried several modifications of the incline—1st. A double road worked by single length of chain, passing round a horizontal wheel, with friction strap upon it, and a second strap to press upon the chain where more retarding powe was required. 2d. For short and very steep gradients such as an angle o 45°, where the nature of the roof precluded the idea of making any opening sufficiently wide to admit of a double road, a line of rails was laid for run ning a counter-weight upon, which assisted the friction brake on lowering the carriage when loaded, and was of sufficient weight to raise it when empty. 3d. A single road and pulley, with the chain running under the descending wagon, until the two meet upon a platform midway. At this place the empty wagon is removed from its position below the loaded one and put upon the rails above it, the chains being at the same time adjusted so as to run under the ascending empty wagon. The latter mode may be applied with advantage where the work to be done does not warrant the erection of a proper machine.

Where hitches in the strata are numerous, and the field unexplored, in drawing loads, such as from 12 to 15 cwt., it will be found the cheapest plan in many cases to go over these at a high angle—45°, or whatever is the angle of the rise, or slope of the dislocation. To work this a small crane can be used, whereby one man can lower the loaded wagon and take up the empty one with ease.

When it is kept in view that the present yearly output of coal in Scotland is upwards of 10,000,000 tons, and the output of limestone, ironstone, and other minerals will be about 3,000,000 tons, an idea can be formed of the

and importance of the matter to which attention has been di-ewed as a money matter, and taking 1s. per ton as the average r underground transit on all minerals raised, the total amount is lthough from the statements here given perhaps £1,000,000 earer the real amount.

Notes, Queries and Correspondence.

scarcely say that we cannot hold ourselves responsible for the pinions of our correspondents; although we shall make it a ndeavour to exclude those which are obviously inaccurate or , as far as is consistent with our wish to encourage the freest .]

ERCY'S METALLURGY AND NAPIER'S PROCESS.

ill you allow me a little space in your Magazine for a few re- Dr. Percy's letter in your last Number upon my notice of his ther, of a small portion of his book. If the castigation which as imagined himself giving me has relieved him in any way (it y be done for any other purpose), I will personally rejoice, al- done in bad taste; for, he having admitted the positive cor- some, and probable correctness of others, of my statements, it been more in keeping had these admissions been prefaced with of gratitude. For the doctor, being desirous, no doubt, of mak- : as free as possible from gross errors, should be thankful, when ot in, to have them pointed out.

nce to that part of my remarks where I gave it as my opinion tor had not treated Mr. Napier's experiments on calcination in would have expected of him, he says, "My reasoning is based ier's own analytical data, and if my conclusions be erroneous, glad to see them disproved." This is exactly what I objected umption of such a position over a fellow-worker in the same now several years since the doctor made the criticisms referred of his public lectures; and, if my memory serve me right, in the ge as printed in his book. I still hold as my opinion, that if, years, the doctor had got some of his Swansea friends to fur- th samples taken out of a calcining furnace, as Mr. Napier says put the matter to the test, he would have done better service to an he has done.

graph on Napier's patent, its success or failure, quite satisfac- that the doctor has ventured upon ground beyond his per- ledge. He has either forgotten, or did not know, that two s wrought at the Spitty works; and all the information he has out these works has been unwittingly confused and identified e patent. He might have suspected that his information was sistent about the patents, if the Company has been at the ex- ouble of obtaining an extension of a patent which he made out en obliged to abandon from unfavourable balance sheets. The that I having admitted that Napier's process was abandoned is nt fact. This kind of special pleading will not do. I never he fact of the discontinuance of Napier's process; but contra- ncorrect statement made in Dr. Percy's book, which he cannot

I accept the doctor's explanations as to the meaning he intended to convey in the paragraph in reference to the estimates of the copper in the furnace bottoms; but it renders that part the most ambiguous portion of the book, for I cannot suppose any reader to take out of it the meaning the doctor intended to convey. The estimation of furnace bottoms is an interesting subject, and one the doctor might have made a very instructive article upon. Furnaces have individual peculiarities, like many things else, in working, absorbing, and other qualifications, which an intelligent manager observes and studies; and he, or other practical men long in the works and familiar with the furnaces, are the most able to give any thing like an approximate estimate of the value of the bottoms. An estimate made by strangers is much less to be relied upon, and smelters know this. The results obtained by purchasers prove the remarks just made; for I believe neither of the men who estimated the Spitty furnace bottoms were capable of falsifying their estimate.

I think the doctor will not fail to see the justness of my remarks, that volunteering such information, apart from all the counteracting circumstances, is not consistent with the true spirit of the book, and is damaging to its character; and I am sorry to say this is not the only instance where statements are volunteered a little out of the rules of propriety for a book of merit and pretension. While I say this, I can also say that few of its readers will appreciate the book for its intrinsic worth as a whole more than I do.

AN OLD SMELTER.

COPPER SHEATHING.

SIR,—The article upon Copper Sheathing in Dr. Percy's *Metallurgy* is full of interest, and strikes me as giving strong evidence of what I have long believed,—that our knowledge on this subject is very defective, and reflects little credit on us as a practical people. When the names of Davey, Daniell, and Miller are given in connection with this subject, it might appear to be a sufficient guarantee that full justice has been done to the inquiry; but this is really not so, for their investigations have been too limited for the requirements of the inquiry. It is remarkable how few analyses have been made on the subject; and Dr. Percy could do no greater service to the Navy, and to the shipping interests of the country generally than by devoting a portion of his time to this important subject.

To say that a vessel was sheathed with copper made from a mixture of Cornish or other ores, and that it lasted for such and such a time, is not the class of inquiry which will satisfy chemists and metallurgists at the present day. Dr. Percy merely repeats a sort of popular prejudice, that the great deterioration of the copper sheathing dates from the introduction of foreign ores into this country. But there is really no evidence to show that these foreign ores contain any thing that the Cornish ores do not contain; on the contrary, the Australian ores are known to be of the best and purest description. My opinion is, that the deterioration of the sheathing since 183[illegible] is connected with the operation of Muntz's patent, which came into use at that period, and which has been gradually extending, until, at the present time, all the copper smelters have it in use. The manner this process affects the general character of the copper is this: the copper for making the yellow metal is necessarily *selected*, and consequently, the portion of regulus left alter the selection being less pure than the selected portion, it follows that the copper made from it is inferior to that which would have been produced from the same ore if no selection had been made, and the whole had been brought into a state of tough copper. It is evident that such a process of selection unavoidably tends to deteriorate the quality of the copper used for ordinary purposes; for all the copper left after selecting is

ꞏrted into *tile copper*, but as much of it as will roll is made into sheathing and other purposes. I am convinced that a thorough investigation into the whole question of sheathing would prove ꞏo be correct, and show that a homogeneously pure copper sheathꞏst much longer than copper made from a great number and vaꞏfferent regulus, left from the selecting process.

Your obedient servant,

METALLURGIST.

ꞏh, *March* 12, 1862.

ꞏing, Quarrying, and Metallurgical Intelligence.

ꞏ ASSOCIATION OF GREAT BRITAIN.—A meeting of this Associ- held at the Craven Hotel, London, on Friday, March 7, when a ꞏle number of gentlemen, representing different districts throughꞏuntry, were present. Mr. Nicholas Wood, the chairman of the ꞏn, presided, and several matters of great importance were brought meeting, among which were the "Accidents Compensation Bill" Parochial Assessment Bill." With reference to the first of these it was resolved that steps should be taken to oppose it; but no was come to respecting the second, it being deemed more expeꞏit until the select committee appointed to inquire into the matꞏ begin to examine witnesses, when, if necessary, evidence might touching the effect the measure would probably produce on the ꞏ mine-owners. Other subjects of interest came under discussion; ꞏeting declined to take action in connection therewith until they ꞏed into feasible proposals. On Saturday afternoon the chairꞏnpanied by several members of the Association, had an interview ꞏeorge Grey, the result of which was considered upon the whole ꞏ.

CORNWALL AND DEVON.

ꞏchy of Cornwall account of revenues for 1861, just laid before ꞏ, shows:—Balance from previous year, £9273 16*s*. 11½*d*.; rents ꞏ of courts, £32,288 11*s*. 8½*d*.; royalties on Somersetshire coal ꞏ99 5*s*. 11*d*.; royalties, dues, and rents of mines and quarries in ꞏnd Devon, £6092 19*s*. 5*d*.; annuity from Consolidated Fund in coinage dues, post groats, and white rents, £16,216 15*s*.; diviꞏtock, £2367 9*s*. 4*d*.; interest on balance of money expended in ꞏse of toll tin, lease, and expenses, £554 1*s*. 3*d*.=£70,592 19*s*. 6¾*d*. to H. R. H.'s treasurer, £30,840; purchase of copyhold at ꞏ, £1299 18*s*. 11*d*.; expended for the benefit of the estate, 2¾*d*.; allowances to duchy tenants, &c., £3182 8*s*. 4½*d*.; sunꞏding superannuation allowances and annuities, donations, and ꞏc., £2061 9*s*. 1*d*.; expenses of management, £6495 17*s*. 11*d*.; ꞏdit balance, £23,801 8*s*. 0¾*d*. The balance at the bankers' is ꞏgher than at the end of the preceding year. The amount of ꞏsted in Government stocks is £85,208 8*s*. 10*d*., which has graduꞏulated from enfranchisements and sale of estates, and princiꞏcharges similar to those on the receipt side of the above revenue

ꞏrt Temple has been appointed Secretary to the Commission to inquire into the condition of metallic mines. The Commisꞏow received their formal instructions from the Home Office,

and have established themselves in Old Palace Yard. The name of Mr. Richard Davey, M.P. for West Cornwall, has been substituted for that of Mr. J. D. F. Davie in the Commission.

The continued fall in the standard of tin-ore is becoming serious for the large producing deep mines, and a feeling of dissatisfaction is beginning to be expressed at the smelters. There is talk of some large mines—such as Dolcoath—again repeating an operation tried with success (as the miners conceive) before; that is, the "stocking" of a portion of their tin for a better price.

It would be a curious task to trace the history of some of the numerous mines in these counties which have recently been abandoned, under the pressure caused by the recent absence of speculative feeling. We propose, in an early Number, giving our readers a history of this kind, beginning with Great Wheal Alfred. We also propose giving regularly, after the present Number, a description and history of all new concerns proposed to be brought out. There are several now on the *tapis*, viz. Wheal Abraham and Crenver, Wheal Neptune, Catheral, and a few others.

WALES AND THE BORDERS.

South Wales.—The inquest on the Cethin Colliery accident has resulted in the following verdict: "In the inquiry into the cause of the death of Samuel Jones and others, we find, 1st, That the ventilation of No. 1 Cethin pit was deficient in quantity, badly arranged, and liable to frequent interruption; 2d, That the viewer disregarded the 1st general rule, and also permitted that special rules, Nos. 16, 18, 24, 26, 31, 34, 37, and 63, to be generally disregarded by his officers; and we find a verdict of manslaughter against John Moody."

The evidence of Mr. Thomas Evans, Government Inspector of the district, of Mr. Lionel Brough, Government Inspector of the West of England, and of Mr. Kenyon Blackwell, the Commissioner sent down by the Home Secretary, all concurred in stating that the ventilation arrangements were defective. Mr. Evans said: "I do not think that the distribution of the air is well arranged, and the ventilation is too nearly balanced, and not sufficient to meet extraordinary circumstances; such as the condition of the atmosphere, falls, or other obstructions." With regard to the relation between atmospheric pressure and explosions, the following observation of Mr. Brough is of considerable interest: "I have only to state that much observation has been given to the subject, and the fact of reduced atmospheric pressure at the moment of some of the great calamities has been established; whenever the barometer is low, I am always myself apprehensive of danger. The mercury is said to have been 29¼ inches at Swansea on the day of the Cethin catastrophe, and this may be considered a point low enough to excite anxiety, and induce extra care and caution in any pit where the coal is known to exude carburetted hydrogen gas." Although the evidence thus went on to prove that the ventilation of the pit was weak and ill-arranged, and also that there had been certain distinct breaches of general rules, yet it is doubtful whether the failure was of such a nature as to justify the verdict of the jury. It seems out of the question to suppose that a conviction for manslaughter will result from such evidence; and the matter may be expected to end, as many similar inquest verdicts do, in a matter-of-course acquittal at the assizes.

A live frog is alleged to have been found at the Tyr Nicholas Colliery, near Newport, on March 10, in the rock vein coal, 200 yards below surface. Mr. John Russell, the manager of the colliery, vouches for the fact, and proposes sending the block of coal, in which the frog was found, to the Great Exhibition. According to the latest accounts, it was alive and active.

The iron trade of this district has recently shown unmistakable signs of improvement. This is mainly attributed to the favourable operations of the

riff, and especially to the concessions which have recently been ı reference to the importation of iron into France. Since the ment of the American war, our ironmasters have been hard at ying to open new markets for the precious hardware, and it must d with gratification that they have succeeded to a great extent, aly, Spain, and other continental countries, having sent hither 's; and large shipments are now being made to Toulon, Alicante, Barcelona, Naples, &c. The Tredegar Iron Company have a ı hand for the supply of 10,000 tons of rails, which are required nstruction of the Italian railways. The Ebbw Vale, Beaufort, , and Blaina Companies, are also better stocked with orders than he case for many months past. Of the five furnaces at Ebbw are now lit; but there are evident signs of another being soon put Two out of the five are also lit at Victoria; and at Beaufort, four nine furnaces. The coal trade may be said to be in *status quo*, proving nor more depressed. Although the home coal market plorable condition, yet the coasting trade of Newport has but it the effects of it. The wharves on the river side, where nearly sters load, are fully occupied, and the fair wind which has set in : few days has enabled a great many vessels to leave the port for ective destinations. Freights are moderate, and the complaints e made of the scarcity of tonnage are gradually disappearing.

ETHSHIRE.—Probably the most striking feature of the day in the rld is the progress of gold-mining in Wales. The success of the mpany seems to have revived, to some extent, the mania of 1853, t is to be hoped that the experience then gained will induce a ent system of working. That gold occurs in Wales in remunera- ties is now an established fact; and it seems also clear that a on of Merionethshire has all the geological characteristics of an country. For our own part, we do not doubt but that, carefully 'ly worked, other prizes may be found in the district as well as But the effect of gold in exciting the public mind seems to be quite marvellous; and if Merionethshire mining is approached in , it requires no prophet to fortell numerous failures. Still every ble to be abused; and because the gold district of North Wales ı be made a means of reckless speculation, that is no reason why : importance should be overlooked. Among the new concerns this district is East Clogau, the shares of which are said to have ı up readily by the public. Other concerns in the district are ced by companies from the north, and among these some of the n localities for the production of splendid specimens of auriferous l which are undoubtedly fair speculations. One or two concerns, bout being brought out in the London market, supported by good l respectable names; and, if the public does not change its mind idly, we may expect that they will readily succeed in procuring al.

RE.—During the month of February the total export of white Liverpool and Birkenhead was 40,748 tons, against 60,869 tons esponding month of last year. The countries to which the ex- :: United States, 7854 tons; British America, 3744 tons; South 2 tons; Calcutta, 20,684 tons; Baltic and North of Europe, ; Australia, 769 tons; West Indies and Africa, 2680 tons; and l the Mediterranean, 185 tons; the remaining 3512 tons were rise. The exports of rock salt from Liverpool and Birkenhead s were 2204 tons. From Runcorn the exports were: white salt, rock salt, 1280 tons.

NORTHERN COUNTIES.

NORTHUMBERLAND AND DURHAM.—The prodigal munificence with which the public subscribed to the Hartley Relief Fund has become a source of embarrassment, and may end in serious difficulties. At a recent meeting at Newcastle, the treasurer, Mr. W. Woods, reported that £54,02 was the amount in his hands; in addition to which there was a sum of £18,000 in the hands of the Lord Mayor, and a further sum of £262 to be received, making upwards of £72,000. Of this amount the Finance Committee have recommended the investment of £60,000 in the debentures of North Eastern and Newcastle and Carlisle Railway Companies, and the Tyne Improvement Fund, at rates that will produce £2500 a year interest. The £12,000 remaining will be left in the hands of the treasurer, or invested in securities readily available, to meet current payments. The following five gentlemen were named as trustees of the fund: Sir W. G. Armstrong, Messrs. John Clayton, R. B. Sanderson, jun., Hugh Taylor, and T. E. Forster. The application of this surplus fund is the great question to be decided. It has been proposed by the Committee that it should be applied to the formation of a permanent fund for the counties of Northumberland and Durham; but this is objected to by some, who are, however, willing that the surplus be applied for the foundation of a fund which shall embrace the nation at large. At the last meeting of the general Committee, however, a resolution was passed disclaiming any desire to deal with the fund except according to the wishes of the subscribers. No doubt the proposition to organise a permanent fund for the counties of Northumberland and Durham is a practicable scheme; while an attempt to establish such an organisation for the whole kingdom would probably fail, however desirable it might be to see it accomplished. Mr. Joseph W. Pease, of Darlington has addressed a letter to Mr. Hugh Taylor, chairman of the Northern Coal Trade, containing suggestions as to the establishment of a Miners' Permanent Relief Fund. The *Newcastle Daily Chronicle*, speaking of the coal trade of this district, says it has been worse this year than for the last sixteen years. For household and manufacturing coals the demand has been especially bad. After paying freight and expenses in London, some manufacturing coals lately sent to London from the Tyne have not left two shillings as their price per ton at Shields! Of course at such a price they could not be produced. Bad though this is, the position of some of the London contractors for inland coals is even worse. We hear of fields having been taking in the neighbourhood of the metropolis for storing the coal coming from the midland counties that cannot be sold. The coal agents having bound themselves to take a certain quantity of coals, they are compelled to take them, and, not being able to sell them, they have to be put on in fields in the suburbs, to the great loss, no doubt, of the purchasers.

SCOTLAND.

THE SCOTCH IRON TRADE.—The stock of pig-iron has, during the last two months, increased upwards of 30,000 tons, and is now not less than 630,000 tons, inclusive of Carron. The market remains dull and stagnant; merchants, shippers, and consumers are not encouraged to extend operations beyond the immediate requirements of the home and foreign markets. The effect of he recent prostration of commerce is fully illustrated by the Board of Trade Returns, just issued; and it is futile to anticipate a return of prosperity until some time after the American struggle shall have terminated. The price of mixed numbers, warrants, is to-day 49*s.* 3*d.*, against 48*s.* 3*d.* twelve months ago. No. 1 makers' iron, nominally 48*s.* 3*d.*; No. 3 47*s.* 3*d.* per ton, free on board.

rrie, manager of the Monkland Iron Company, has been appointed rnment Inspector of coal mines in the East Scotland district, r the decease of Mr. R. Williams. Among the candidates were h Moore, Mr Mark Fryar, and Mr. R. H. Wynne, of Hulton Manchester. It is stated that nearly every mine-owner in the istrict recommended some person to the Secretary of State as fit ffice!

ic mining seems to be attracting considerable attention in Scot-chwinnoch Consols Copper Mine, which is now under the man-of a respectable Cornish agent, Captain George, is making a re-pearance in the ticketing list, and seems likely to prove a sub-oncern. A mine adjoining—the Calder Glen United Mines—also management of a Cornish agent, Captain Bailey, seems to be promising. The Lochwinnoch has hitherto only been worked by ls; but now a steam-engine is in course of erection, and a shaft, already down nine fathoms, will be sunk to the twenty. The ore pper, producing from two to eight ounces of silver to the ton; and ietors talk of treating the ore by Longmaid's or Henderson's pro-being satisfied with the price they get from the smelters; they tons of poor ores now available at the surface. The Calder Glen ntly on the same lodes as Lochwinnoch; but the ground is lower, re is yellow; they are also sinking here, and preparing for a gine. Indeed there seems to be quite an enthusiasm for mining Glasgow and its neighbourhood, about which several lead and ines are being started. Smelting works are also being erected at We hope on future occasions to be in a position to give more the progress of Scotland in metallic mining; looking generally ogical features, there appears to be no reason why it should not roductive country.

IRELAND.

ld excitement seems to be extending from Wales across the Chan-he shares in the Carysfort Mining Company have recently risen price in consequence. There can be no doubt that this property, ly-l the foot of Croghan Kinshella mountain, is a gold district. As a fact, it has produced more gold than any other part of the United , including Merionethshire. It was worked by the Government ter part of the last century, and their operations left a profit on ing of the alluvial sands. This profit was certainly ultimately n lost in mining explorations for auriferous veins, which were t with; indeed it is remarkable that in Wicklow not a speck of iver been found *in situ* in a lode, notwithstanding that the alluvial so comparatively abundant.

oposed amalgamation of the Wicklow Mine Company (Bally-Mine) with the old Hibernian Mining Company has been referred mittee. This committee has not yet made its report; and there e certain legal difficulties in the way, which may probably prevent sed amalgamation being carried, if it should be distasteful to any ble proportion of the shareholders. There can be little doubt that gamation would be beneficial to the concern.

METALLURGY.

An improved process of introducing fuel into blast-furnaces, invented by Mr. John Broad, of Handsworth, has been applied at the Park End Works, Forest of Dean, Gloucestershire, where the result is said to be favourable, much of the small fuel now wasted being utilised, and made nearly as valuable in the blast-furnace as the large coke and raw coal.

Mr. A. Parkes, of Birmingham, proposes to improve the quality of yellow metal sheathing, by adding ½ to 2 per cent of tin or aluminum thereto.

THE SPELTER TRADE.—Messrs. Berger report, that since our last this metal has been subjected to many variations: without any immediate cause or reason prices from 18*l.* receded to 17*l.* 5*s.* and 17*l.* 10*s.*; but at this reduction they stopped, and our previous remarks that the stocks in the principal markets are not above the average, were fully proved during the last fortnight, when a sudden rise of 10*s.* up to 25*s.* was immediately established in Hambro' and Breslau by large purchases, made principally for France, where the stocks are very low. Our market followed, and about 1500 tons were done at 18*l.* to 18*l.* 10*s.* spot, 18*l.* 10*s.* delivery; but prices abroad are still above ours, and it is not unlikely that continental buyers will have to come and buy from us very shortly. We also must expect some demand from India, whence the shipments have been very small for some time.

Stocks on March 1, 1862	.....5123 tons;	price from	£17	10	to	£17	15
,, 1861	4087	,,	18	0	,,	18	5
,, 1860	3264	,,	20	15	,,	21	0
,, 1859	3979	,,	21	5	,,	21	10
,, 1858	1673	,,	26	0	,,	26	10

THE MINES ROYAL COPPER-SMELTING WORKS.—These works, situated at Neath, are now in the market. The lease expired on the 25th March, and the Mines Royal Company have declined to renew on the terms sought to be imposed by the landlord, who insisted on introducing a clause into the new lease, compelling them to consume 24,000 tons of coal per annum. This clause was proposed for the purpose of bettering the coal proprietors on the estate, who supply the works with coal, and whose lease has been renewed with such a clause in it. Efforts are now being made to get another company to take them, subject to this condition; but as yet without success. Negotiations are at present pending with a party in London. The works are in good order, and comprise, 4 ore calciners, 7 ore furnaces, 2 metal calciners, 5 metal furnaces, 2 roasting furnaces, and 1 refining furnace,—all new and ready to put the fires in, with room in the buildings for 25 furnaces more, and quite sufficient for the smelting and refining of from 50 to 60 tons of copper weekly. There is water for vessels of 150 to 200 tons. Canal to Swansea, rail within 1½ miles, and another line (narrow guage), to be made this year, passing within 150 yards of the works, with which it will be connected by a siding. This latter line will open a direct communication with the whole midland system. The works altogether are undoubtedly most desirable, from their general suitability and compactness; the only objection is the coal-clause above referred to.

Mr. F. Fowler Bankhart, late of the Britton Ferry Copper Company, has been appointed manager of the smelting operations of the Cobre Mining Association, who have determined to smelt their poorer ores in Cuba.

FOREIGN AND COLONIAL.

While home mining is languishing from want of support, the tendency to invest in any foreign scheme seems to be reaching almost the proportions

of a mania. Gold seems particularly in the ascendant abroad as well as at home; and particularly the great success of St. John del Rey has drawn up a host of neighbours. These may be fair speculations enough; but it is quite clear the public are equally prepared to rush into concerns which afford no guarantee either as to the character of the ground itself or of those connected with the speculation. Foreign mining, in good hands, has had some splendid successes; but it has also been the means of causing terrible losses, and will be so again if approached in the spirit which now seems dominant. The present generation seem to have forgotten the great losses of the last generation in foreign mines; but if they are not cautious, they will soon learn it to their own cost.

New South Wales.—By the arrival of the Australian mail we have news from the coal-field of New South Wales down to the middle of January. The most important items of intelligence are subjoined:—

The *Maryborough Chronicle* reports that a seam of coal has just been discovered about eighty miles or so from Port Denison. It is said that the quality is most excellent, and that there is abundance of the article. Copper ore has also been found in the same locality, and there is now no doubt whatever but that the whole district abounds in mines, chiefly copper. Capital is required to work it out.—The *Newcastle Chronicle*, published in the Hunter River district, announces that a very fine seam of coal has been found about a mile and a half from New Chum's Flat, towards the Waitahuna. It is found about six feet below the surface, and it is said to be the best coal yet found in the Province. The seam is about three feet through.

The *Queensland Times*, in an article on the history and progress of Queensland since its separation, has the following:—Perhaps the next in importance to that of our pastoral resources are those of our mines. Of coals we have an illimitable supply, the principal pit in operation at the present time being that of Redbank, about eight miles from Ipswich, near the junction of the Bremer and Brisbane rivers. The owners of the mine, Messrs. Campbell and Son, have for some time past been supplying the Australasian Steam Navigation Company with the coal required for the use of the steamers plying between Sydney and Brisbane, and between Brisbane and the northern ports. Besides this, a considerable portion of the coal consumed in the towns of Brisbane and Ipswich is supplied from this mine. The proprietors have lately sunk a second shaft to a bed of superior coal very similar in character and appearance to the cannel coal of the north of England. The Maggill Pit, on the Brisbane River, has been closed for some months through the failure of the lessee. The pits of Messrs. Walter Gray and Co. at Cluman, near Ipswich, are being re-opened, in anticipation of an extended trade. We see by the last mail from England, that the *Times* congratulates the Peninsular and Oriental Steam Navigation Company, and other great companies, on the fact that coal has been discovered in Tasmania, and that, therefore, a great saving may be effected by the use of that coal in the event of the companies adopting it in preference to English, which they are compelled to send out by sailing vessels at great expense; and in the event of new steam routes being adopted, Tasmania is pointed out as an excellent depôt from whence to obtain coal. We trust that the day is not far distant when we shall possess a line of steamers through Torres' Straits; and when we do so, we shall be able to supply them with excellent coal, without their going so far out of the way to obtain it as to Tasmania; and what is of equal importance, we can supply it at a cheap rate too.

The following statement shows the quantity of coal exported from Minmi during the year 1861. It will be observed, that from August 24th to October 19th, only 1326 tons were exported, and they were despatched during the week previous to the 19th. The eight weeks of the strike are included in that period:

			Tons.	cwt.	qrs.
Fortnight ending January	12	....	2085	15	0
" " "	26	....	3383	19	0
" " February	9	....	2186	3	0
" " "	23	....	1536	15	0
" " March	9	....	3552	10	0
" " "	23	....	3443	15	0
" " April	6	....	3386	5	0
" " "	20	....	3702	10	0
" " May	4	....	2642	13	0
" " "	18	....	2664	18	0
" " June	1	....	2098	15	0
" " "	15	....	3935	2	0
" " "	22	....	3528	6	0
" " July	13	....	3020	6	0
" " "	27	....	2222	6	0
" " August	10	....	2196	2	0
" " "	24	....	1438	3	0
" " October	19	....	1326	0	0
" " November	2	....	2251	2	0
" " "	16	....	998	0	0
" " "	30	....	1641	10	0
" " December	14	....	3073	10	3
" " "	28	....	2546	18	3
" " "	31	....	227	15	0
Total		....	59,089	6	2

At the sitting of the Legislative Assembly, on the 31st December, Mr. Lewis obtained leave to introduce a bill for the better regulation of coal-fields and collieries. On the Friday following, namely on the 3d of January, Mr. Lewis moved the second reading, which was carried after considerable discussion. The bill having been read a second time, Mr. Lewis consented to let it lapse for the present.

New Brunswick.—In the British Province of New Brunswick in 1851 the product of the coal-mines was 2842 tons; in 1861 the coal product was 18,244 tons.

Canada.—The *Detroit Free Press* has the following on the coal-oil trade. About three hundred wells are sunk and in progress at Enniskillin, Canada West; and the monstrous flowing well, which we noticed a few days ago, is said to be capable of yielding oil sufficient to load a four-hundred-ton vessel daily. This flow has been curtailed by tubbing, so that the daily yield now is only about six or seven hundred barrels, which are being taken care of. Other wells, as good or better, will doubtless be opened in this locality, and the supply of oil will be limitless. These wells are only about fifty miles from this city, not far from the line of the Grand Trunk Railway, and approachable to within fourteen miles by the largest lake-boats. The crude material must find a market for manufacture here. Already many Michigan capitalists have invested in claims in the oil region. About 300,000 dollars have been expended in digging wells, erecting refineries, opening roads, &c. There are already half a dozen oil refineries in this State, and some of them on a very extensive scale. Others will be erected as the occasion may require, and this branch of manufacture may yet prove the most important in our city or State. The coming spring will doubtless witness great activity both in manufacture and shipment. Letters have been received from England and Scotland, which indicate that the market is to be very great, and the demand will possibly be greater than the supply can fill.

Metal Markets.

; weekly reports from Messrs. Von Dadelszen and North,
ion of the metal market during the month.
Business in metals has been very quiet. The downward
opper and spelter has been followed by an actual decline
ators still use the greatest caution in their purchases.
officially reduced on the 1st inst., ½d. per lb. for manu-
4l. 10s. for tile and ingot; but the market is still very
purchases can be made at 10¼d. per lb. Foreign is dull and
ote Burra Kapunda 95l. and Chili 86l. to 87l.
t its position very well; Straits 117l. to 117l. 10s. cash, and
0s., 3 months open. A small parcel of Banca sold yester-
English unaltered. The Dutch market quiet, at 74f. to ½.
quiet but steady, at previous quotations.
emely dull.
lower; sellers on the spot at 17l. 10s., and no demand for
ry.
—We do not see as yet any signs of an improved demand
The business done since our last report hardly calls for
nd the cheapness of money does not encourage speculators
he low prices now ruling.
h bars sell very slowly, at 5l. to 5l. 2s. 6d. f.o.b. Wales,
15s. to 6l. here. Staffordshire iron remains very dull. A
s has been done in Scotch pig iron, closing firm at 49s. 3d.
three months open.
very dull until yesterday, English manufacturers selling at
cake and ingot 93l.; now the market is firm; 10½d. asked.
urra has been reported at 95l., but few sellers now thereat;
Chili, 86l.
t steady. English unaltered. Straits 117l. cash and 118l.,
prompt. Banca, 125l. nominal. The Dutch market has
.
—The demand has fallen off, but prices are unaltered.
little business doing, with a dull market.
n Monday 100 tons were done at 17l. 5s., since which the
sumed a firmer tone; yesterday about 250 tons changed
0s. spot and for forward delivery, at 17l. 15s. Hull parcels
s.; W. H. 18l. 5s.
-There has been an improved demand for some kinds of
anied with a slight advance in value, whilst others have
t with a drooping tendency.
he demand for manufactured having improved, the smelters
fixed prices, but secondhand lots can be bought a trifle
n has slightly improved; 96l. paid for Burra, and 97l. now
ida 97l. For Chili 87l. has been offered and refused.
dull of sale. We quote Straits 117l. cash and 118l.—
rompt. Banca nominally 125l. The Dutch market is dull
English unaltered.
—The manufacturers are completing old contracts; the
k and prices unaltered.
s in a languid state.
improved, and a fair amount of business has been done on
l. 17s. 6d., 18l., and 18l. 10s., now asked 18l. 5s., offered.
il delivery, were done yesterday at 18l. Hull parcel,
7l. 17s. 6d., W. H. 18l. 15s.

March 26.—The firmness which we reported in our last circula some branches of the metal trade, has been well maintained; there however, an absence of a general demand.

IRON.—Welsh bars move off slowly, 5*l.* the price f.o.b. in Wales, from 5*l.* 17*s.* 6*d.* to 6*l.* here (f.o.b.). The demand for Staffordshire is slowly increasing. Scotch pig iron has advanced to 50*s.* 3*d.* cash, wi further upward tendency.

COPPER.—English descriptions have stiffened in value, though sale trifle under official quotations for manufacturers have taken place to a extent during the last few days. Tough cake and ingots, 95*l.* to For Burra 97*l.* has been paid, and now 98*l.* asked. Kapunda nominally. Spanish 90*l.* Chili in Liverpool, 89*l.* to 90*l.*

TIN quiet, with but little doing. Straits, 117*l.* Banca, 125*l.* nomina The Dutch market dull at 74f. English unaltered.

TIN PLATES.—The demand has fallen off, but prices are fairly ma tained.

LEAD is very dull; good soft English from 19*l.* 10*s.* to 19*l.* 15*s.*

SPELTER.—A large business has been done, both on the spot and spring shipment. We estimate this week's transactions at about 1500 t from 18*l.* 7*s.* 6*d.* to 18*l.* 12*s.* 6*d.*, and there is every appearance of hig prices being paid before long, 18*l.* 10*s.* spot the closing price.

Metallic-Ore Markets.

TIN.—The decline in the standards for black tin still continues. the early part of the month the standard was put down 2*l.* per t making the rates:—

Refined	....	£109.
Common	....	105.

In the middle of the month a further decline of 2*l.* was announ making the present rates:—

Refined	....	£104 to 107.
Common	....	103.

On this the *West Briton* remarks:—"This continued decline in p makes a serious difference to our tin mines—the drop during the last years being about 29*l.* per ton on Refined, and on Common, 26*l.* present price leaves a margin between the quoted price of metal black tin in favour of the smelters of 17*l.* per ton."

COPPER.—At the four Cornish sales we give this month, the ave produce, price per ton, and standard, have been as follows:—

	Produce.	*Price per ton.*	*Standard.*
Feb. 27	$6\frac{1}{4}$	5*l.* 1*s.* 0*d.*	125*l.* 0*s.* 0*d.*
Mar. 6	$6\frac{7}{8}$	5*l.* 13*s.* 6*d.*	123*l.* 9*s.* 0*d.*
„ 13	$6\frac{3}{4}$	5*l.* 13*s.* 0*d.*	124*l.* 12*s.* 0*d.*
„ 20	$5\frac{3}{8}$	4*l.* 14*s.* 0*d.*	129*l.* 12*s.* 0*d.*

Compared with the previous sale (Feb. 20), at the sale of the February there was, according to the *Mining Joarnal*, a decline in standard of 2*l.* 8*s.*, while according to the *West Briton* there was advance of 2*l.* At the next sale, March 6, there was an advance o according to the *Mining Journal*, but of only 18*s.* according to the *W Briton*. At the sale of March 13th, there was another advance of 12*s.* or 14*s.* 6*d.*, according as we accept the authority of one of the pa

r the other. At the sale of the 20th, the standard was stationary ig to the *West Briton*, while if we take the figures of the *Mining* , there was a decline of 1*l*. It must be quite understood, that, in g to these discrepancies, we have no intention of reflecting on the ge or accuracy of either of the papers referred to. Our purpose is to show, as we pointed out in our first number, that at present the rd" has little or no meaning, and instead of showing at a glance price of ores has gone, really tends to confuse the subject. That ons most intimately acquainted with it—as those who make the ions in the papers referred to undoubtedly are—differ so frequently estimates, is the best proof that there is really no sound data to go der the present system.

—Comparing the sales of Lead Ore for the month with those former month, there appears to be no material alteration in

London Share Market.

ining Market during the month has shown a great improvement pared with the past few months; the abundance of money, the y of prices, and above all, the very favourable progress made eventual success in one or two instances, have, combined, im- a tone of confidence to the investing public, the absence of r so long a period has been almost a matter of wonder to many lealers and brokers. It is with the greatest pleasure, therefore, hail this revival of business; for if our numerous copper and tin an by their own intrinsic value or merit command the attention public, and moreover of the practical agents in various parts of nd Cornwall, as a source for investing and employing their spare at a period like the present when the metal market remains in couraging a condition, how much more valuable will these es become when the exports of metal again reach their former . Hence the satisfaction felt at the more cheering prospects of month.

American dispute has been quoted from day to day and week to s the main cause of the depression in trade generally, and a t the government returns will at once prove the correctness of ssertions. We therefore, for this, and many other reasons, echo the wishes expressed by many for the early solution and tion of the dispute, and the resumption of commercial and intercourse.

ring to districts, we find that Liskeard mines continue to the greatest favour from the public, and East Caradon has the highest price this month of any yet attained by this ul adventure. South Caradon, Marke Valley, West Rose Down, re received considerable attention. Further west we find East na has made considerable progress, and bids fair soon to become nd mine. Great Fortune, Cook's Kitchen, have also advanced , and have been largely bought up by influential investors.

The following will give the summary of the month's business.

Alfred Consols have been freely offered for sale at much lower prices. The further outlay required for the working of the mine seems to be the cause of this depression.

Carn Camborne occasionally in demand, but scarcely any variation in the quotations.

Clifford Amalgamated continue rather dull at 29-31.

Camborne Vean have declined to 1⅜-⅝., and only a very few transactions.

Cook's Kitchen largely in request, and have improved to 33 buyers; the accounts of the prospects of this mine continue of a highly satisfactory character.

Devon Great Consols have changed hands at 412½, the dividend declared at the meeting held on the 27th ult. was £8 per share.

East Basset very quiet and inactive at 43-45.

East Caradon have fluctuated greatly, and close 83¼-¾, having touched 34¼; the lodes in this mine continue to open out well and productive.

East Carn Brea, after having advanced to 13¼, close rather lower, viz. 12½-¾.

East Grenville have been rather largely dealt in, but close a shade easier.

Great Fortune have been in great favour during the past few days and have advanced to 20, the late improvement in the mine having caused a demand for these shares, large numbers of shares have changed hands, and the prospects of the mine at present are very good indeed.

Herodsfoot: not much business doing, 36-7.

Hingston Down a trifle firmer, 2⅜-½.

Marke Valley have been more offered during the month, and close a little flatter, 9⅞-10; the next dividend is expected to be 5*s*. per share.

North Downs fluctuating, they close 4⅝-⅞.

North Basset: a little more inquiry at 3-½.

North Treskerby steady at 19-20.

Providence more in demand, they close 41½-2½.

Rosewall Hill have declined to 3⅞-⅝.

South Tolgus: occasional dealings at 54-56.

South Caradon very firm at 327½-32½; a dividend of £5 was declared at the meeting held on the 27th ult.

South Frances became in request and rose to 107½ buyers, they subsequently receded, and close 102½-7½.

Stray Park: a little more activity at 30-31.

Tincroft not so firm, more shares offering, 9⅞-10⅛.

Tamar Silver Lead remain nominally, 28*s*.-30*s*.

West Caradon steady and quiet at 40-41.

There have been some inquiries for West Frances, they are quoted 10-12.

West Rose Down not quite so firm at the close, 13-15.

West Polmear, after receding to 2*s*. 6*d*. to 3*s*. 6*d*., suddenly advanced to 7*s*. 6*d*. to 10*s*.; they close, however, 6*s*. to 8*s*.

West Seton 272½-7½, and firm at this price.

Wheal Basset quiet at 99-101.

Wheal Grylls have improved to 17-18, owing to a good report from the mine.

Wheal Harriett have suddenly risen to 25*s*. on a discovery reported on Thursday last.

Wheal Grenville is much improved during the month, the price remains steady at present at 52*s*.-54*s*.

Wheal Uny again in demand at 5¾.

Wheal Ludcott: many buyers towards the close of the month at higher prices.

Wheal Margaret quiet but firm at 44-46.

Wheal Seton, after remaining steady at 121-3 for some days, quickly advanced to 129 buyers; they close 126-128.

West Tolgus much sought after.

Tolvadden have been dealt in to a large number of shares at 8-½.

Trencrom inquired for, 8¼-¾.

New Seton very quiet at 55-60.

North Crofty, 36*s*.-38*s*.

Great South Tolgus: sellers predominate, 8-¼.

Wheal Trelawney 17-18, occasional transactions.

Craddock Moor have been dealt in at 29-31.

Bryn Gwiog has improved lately, and the shares are now firm.

In Foreign mines there has been a large amount of business done, more particularly in Scottish Australian, St. John del Rey, United Mexican, Port Phillip, and Great Northern Copper.

St. John del Rey have receded, and close 58-60.

United Mexican have also declined to 7¼-½, at which they close.

Port Phillip ⅞-1, being a shade firmer than for the last few days.

In other Foreign mines not much variation to notice.

Thursday, 3d April, 1862. 2.30 P.M.

The following are the closing prices :—

For the last few days the Markets have been scarcely so active, speculation being most wholly confined to the new loans, banks, &c., recently brought before the iblic; the quotations of mines have, however, generally been firm.

Carn Camborne, 12/ to 14/; Camborne Vean, 1¼ to ½; Cook's Kitchen, 34½ to ; Devon Great Consols, 400 to 5 ex div.; East Basset, 43 to 45; East Caradon, ⅝ to ⅞; East Carn Brea, 12⅝ to ¾; Great Fortune, 20 to ¼; Herodsfoot, 36½ to ; Hingston Down, 2⅜ to ⅝; Marke Valley, 9⅝ to ⅞; North Downs, 4½ to ¾; rth Basset, 3 to ½; North Treskerby, 21 to 22; Providence, 41 to 42; Rosewall ill, 3¼ to ½ ex div.; Rosewarne United, 21 to 23; South Caradon, 330 to 32½; uth Frances, 97½ to 102½: Stray Park, 29 to 31; Tincroft, 9⅞ to 10⅛; West ances, 10 to 11; West Rose Down, 11 to 13; West Seton, 270 to 75; Wheal ylls, 27 to 9; Wheal Harriett, 25/ to 7/; Wheal Grenville, 57/ to 59/; Wheal ry, 7 to ¼; Wheal Ludcott, 4⅛ to ¼; Wheal Margaret, 44 to 46; Wheal Polmear, to 18; Wheal Seton, 128 to 30.

Provincial Share Market.

DUBLIN.—The following report is condensed from the *Mining*
—At the close of the last month considerable fluctuations took p
shares of the Mining Company of Ireland, which from £17. 10s.
were at one time in demand at £18. 17s. 6d. This was not sus
at £18. 10s. cash, and £18. 15s. for account, they leave off in fa
making an advance of £1. to £1. 5s. General Mining Co
Ireland shares were weak at £5., so were Connorree shares
and Carysfort shares have not moved, remaining nominally qu
Wicklow Copper Mining Company shares have receded from
per share, in consequence of the present unsettled state of the
pending the consideration of the desirability of an amalgam
the Hibernian Mining Company, recommended by the dire
shares were on sale at £51., being a fall of £2.

In the early part of March large aud numerous transac
place in the shares of the Mining Company of Ireland a
Wicklow Copper Mining Company; the former rose to 19l. a
for account, and continued in demand at a trifling reduction or
—at 19l. or 19l. 2s 6d. for account, or an advance of 10s.
Wicklow Copper shares fell further to 50l. each, at which price
firm when the committee of investigation and the directors o
pany met for the first time. Later on they rose to 52l. to 53l.
54l. buyers, sellers at 54l. 5s., or an advance of 3l. 5s. per share
to realise, however, brought them down again to 53l. Conn
found buyers at 29s.; Carysfort shares nominally quoted at 8s. 6d
General Mining Company for Ireland shares would not be ta
at a great reduction.

Towards the middle of the month, Wicklow Copper Mining
shares, which a fortnight before were procured in large numb
and then rose to 54l., buyers, receded to 51l. The Mining C
Ireland shares fell to 18l. 12s. 6d., and again rose to 19l., at
they were freely taken. Carysfort shares changed hands at 9s
General Mining Company for Ireland shares unusually weak,
being offered for them, although ineffectually. Connorree sh
at 30s. to 30s. 6d. each.

Further on in the month Mining shares were in consider
with a steady tendency to improvement in prices. Wickl
shares, which had been at 51l. sellers, exchanged hands at 50
all that offered at 50l. 15s. were readily taken, sellers dem
The shares of the Mining Company of Ireland particularly s
an improvement of 5s. on last price, or at 19l. 5s. for cash, and
for next account. Carysfort shares, which had been procurabl
gradually rose to 11s., 11s. 6d., and 12s., and some of the fr
this company, fully (at 2l. 10s. per share) paid up, sold at
1l. 7s. 6d. per share, or at a discount of 50 per cent. Conn
changed hands at 32s. In General Mining Company for Ir
no business done.

EXTRACTS FROM MINING CIRCULARS.

From MESSRS. WEBB AND GEACH, 8 *Finch Lane, London.*

narkets have been very active throughout the week, and buying predominate. Some of the good tin mines have come into great t in consequence of good improvements. The most extraordinary e has been in Great Fortune, which, on Monday, at once rose 2*l.* are, and has maintained the price; these shares have now, in a few s, risen from 12*l.* to 20*l.* The 78 east of Painter's Shaft is said to lendid course of tin. There has also been a good demand for Tols, although the price has fluctuated most considerably from 3*l.* to Cook's Kitchen have been in extraordinary request, with shares scarce, though the price has advanced to 33 buyers. Devon Consols, 410-15, and quiet. East Bassets continue very flat under re of sales, and are quoted 43-45. East Caradons continue to te very considerably, with a very little change in the value of the They have been as high as 34½ buyers, and are to-day 33¼-½, and The report from the mine on the 24th was as follows:—"50 east good, now worth 60*l.* per fathom; 61 east worth 55*l.* per fathom. Lode: 60 west worth 20*l.* per fathom; 60 east worth 12*l.* per *Fawcett's Lode:* 60 east worth 12*l.* per fathom." This mine is reely dealt in on the market than any other.

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n MESSRS. WATSON AND CUELL, 1 *St. Michael's Alley, Cornhill.*

market has been without much variation since our last. East Carn reached 13¼-13¾, but became weaker on Monday, and leave off 12¾- East Caradons opened very firm at 34, but leave off 33-33½. From port in another column, it will be seen that the 60 is not looking so well, but it is too much to expect that such a lode can continue t temporary fallings off. West Caradons have been more inquired Wheal Grenvilles have been in great request, and advanced to 3. ine is daily improving, and may soon rival East Carn Brea. East lles are also better. West Trevelyans are at 2*l.*, buyers. Grambler . Aubyns not so firm. Great Wheal Fortunes have advanced to and in good request. West Polmears in demand, at improved Wheal Setons have advanced to 129-131. South Caradons in equest, at an advance. Providence Mines rather quiet. Rosewall nd Ransoms not so firm. Kitty (Lelant) up to 14-14½. Ludcotts ½, and flatter again.

From MR. P. WATSON'S *Mining Circular.*

AL GRYLLS.—Agent's report:—"Fisher's Lode: At Annie's enginewe have commenced driving east and west at the 30 fms. level. In l east the lode is worth 35*l.* per fm., and west 30*l.* per fm. At the . level west the lode is producing a little tin, but not rich. The in the bottom of this level, east of the shaft, is suspended, by reason much water, but we expect it will be drained in a few days by the oms level. The lode is worth 25*l.* per fathom. In the end east of t-rod shaft the lode is worth 7*l.* per fathom.—Georgia Lode: In gine-shaft there has been no lode taken down since last reported on, e wall is presenting a favourable appearance, and when last cut h it was worth 30*l.* per fathom. In the adit end north of the shaft de is a little improved, worth 50*l.* per fathom. In the rise in the here is no alteration; the lode is worth 30*l.* per fathom. At the 33 s level driving north the ground is in a disordered state, and is not t through the influence of the copper lode." From the above report be seen that the mine has further considerably improved, and that eper the mine is worked, the richer it is in every part. Shares 20*l.* , and very scarce.

THE CORNISH MINE SHARE MARKET.

(From the *West Briton.*)

March 27.—There has been a very fair amount of business doing in the Mining Market, and prices are generally steady, with the exception of Great Fortune, which on a report of a good course of tin being cut in the 78, rose from 17 to 20, and continue firm. Uny have also advanced from 5 to 6; at the meeting on Monday there was a debit balance of 1940*l.*, and a call of 5*s.* per share was made (1024*l.*); the returns for the last quarter more than paid the costs, but a lot of new machinery was required, hence the call; in the next quarter good profits will be made. Cook's Kitchen in request, 31½-32½. Tincroft, 10½-11. Basset 97-99, and rather flat. At East Basset on Monday, a 2*l.* dividend was declared, but shares close rather flat at 41-42. North Treskerby, 19-19½; Tresidder's shaft reported looking well. South Tolgus 54, ex div. of 30*s.*, declared on Tuesday. West Tolgus, 30-32. Margaret 45-46, and looking well. Providence, 42-3. At Rosewall Hill and Ransom, the first dividend of 3*s.* per share (300*l.*) was declared on Wednesday, leaving 350*l.* to the credit of the next account; a good report was read from the manager, Captain Treweeke, who said he considered the mine in a very thriving condition. Kitty Lelant, 14½-15½, much in demand and scarce; a 10*s.* div. is expected on Wednesday next. Trencrom 3½-¾, rather more than paying cost. Wheal Seton have advanced from 122-130, and close firm at 127-128. Botallack is looking remarkably well, and will, with a good price for tin, pay large dividends; they have also a considerable improvement in the copper part.

The Gwinear Mines are very flat. Rosewarne United as usual have receded from 33-35 to 22-24; this is very vexatious to those who were persuaded to buy on the late rise. At Rosewarne Consols meeting on Tuesday, the accounts showed a debit balance of 2*l.* 5*s.* Alfred Consols, with Great Alfred we fear, is likely to stop—a bad job for the district; the former shares 5*s.* call paid. East Alfred flat, 15*s.*-16*s.* Tolvadden reported improved. At Boscundle meeting on Tuesday, the accounts showed a debit balance of 900*l.*; a call was made of 10*s.* per share (1140*l.*).

At East Providence a call has been made of 2*s.* 6*d.* per share (512*l.*). Wheal Jane 17*l.* ex div.; tin in the stone has been sold for 996*l.*, and black tin, 124*l.*; this is one month's sale exclusive of lead or mundic, which will realise 500*l.* more. At Wheal Reeth meeting the debit balance was 3251*l.*, and the loss on the quarter's working, 1110*l.*; a call of 5*l.* per share was made. It is said the new Tin Smelting Company at Redruth are quite prepared to purchase ores at the present time, so that we may expect shortly to hear of their being active buyers.

At West Providence meeting on Monday, the accounts showed a debit balance of 1255*l.* to the end of January; it was resolved that all operations not absolutely necessary be suspended. At Trevenen and Tremenheere on Tuesday, a call of 3*s.* per share was made (840*l.*). At South Crofty on Monday the accounts showed a debit balance of 1084*l.*; a call was made of 1*l.* per share (937*l.*). At Nanjiles on Tuesday, a call of 30*s.* per share (1536*l.*). At Wheal Vivian a call of 20*s.* per share (512*l.*).

Prices Current of Metals.

			£	s.	d.		£	s.	d.
			Per Ton.						
IRON	Bars	in Wales	£5	2	6	@	£5	5	0
	,,	,, Liverpool	....				5	15	0
	,,	,, London...	6	0	0	,,	6	5	0
	Nail Rods	,, Wales	5	12	6	,,	5	15	0
	,,	,, Liverpool	6	10	0	,,	7	5	0
	,,	,, London...	7	5	0	,,	7	15	0
	Hoops (Staffordshire)	,, Liverpool	7	15	0	,,	8	10	0
	,, ,,	,, London...	8	5	0	,,	8	15	0
	Sheets ,,	,, Liverpool	8	10	0	,,	9	5	0
	,, ,,	,, London...	9	0	0	,,	9	15	0
	Bars ,,	,, Liverpool	7	0	0	,,	8	0	0
	,, ,,	,, London...	7	10	0	,,	8	10	0
	Scotch Pig (No.1.g.m.b.)	the Clyde	2	10	0	,,	2	10	6
	Rails	in Wales	5	5	0	,,	5	10	0
	Russian	C.C.N.D	....				...		
	Swedish—Hammered—large sizes.		11	10	0	,,	11	15	0
	,, ,, Indian sizes		11	10	0	,,	11	15	0
STEEL	Hammered—faggot		...			,,	16	10	0
	,, in kegs ½ and ⅝ in.		....			,,	15	10	0
COPPER	Australian and other *fine* Foreign		97	0	0	,,	98	0	0
	Foreign Slab, for Prod. 96 per Cent.		....			,,	88	0	0
	English Tile and Tough		95	0	0	,,	98	0	0
	,, Best selected		98	0	0	,,	101	0	0
			Per lb.						
	,, Sheets, Sheathing and Rod		10¾*d.*			,,	11*d.*		
	,, Flat Bottoms		11¼*d.*			,,	11½*d.*		
YELLOW METAL	Sheets, Sheathing and Rod		8½*d.*			,,	9*d.*		
			Per Cwt.						
TIN English	Common Blocks and Ingots		....				120*s.*		
	,, Bars (in barrels)		....				121*s.*		
	Refined		....				122*s.*		
Foreign	Straits		....				117*s.*		
	Banca		....				125*s.*		
			Per Box.						
TIN PLATES at Liverpool 6d. Less.	Charcoal IC		28*s.*			,,	29*s.*		
	,, IX		34*s.*			,,	35*s.*		
	Coke IC		22*s.*			,,	23*s.*		
	,, IX		28*s.*			,,	29*s.*		
			Per Ton.						
LEAD	Sheet		£21	0	0	,,	£21	5	0
	Pig—W.B.		21	0	0	,,	21	5	0
	,, ordinary brands		....				20	0	0
	,, Foreign, soft		....				19	10	0
	Red		....				22	0	0
	Shot		....				22	10	0
	Dry White		....				27	0	0
SPELTER	(Cake)		....				18	10	0
ZINC	(Sheet)		....				23	0	0
			Per Bottle.						
QUICKSILVER	(in bottles containing 75lbs. each)		....				7	0	0
			Per Ton.						
REGULUS OF ANTIMONY, French Star			....				47	0	0

Large sales of *Scotch Pig Iron* have been made this week, and the price has advanced about 1s. per ton.

In other articles there is no new feature to notice, prices being without change, but not much doing.

Copper Ores.

Sampled Feb. 12, and sold at Tabb's Hotel, Redruth, Feb. 27.

Mines.	Tons.	Purchasers.	Price.		
Great Wheal Busy	72	6	£1	17	6
	71	14	1	18	6
	68	6	3	0	0
	65	6	2	4	0
	64	6	2	16	0
	62	6,8,9	2	9	0
	61	10	2	5	6
	60	6	2	13	0
	46	6	3	8	6
	36	3	2	5	6
	34	6	2	0	6
	1	6	30	7	0
South Caradon............	103	8	5	19	6
	95	6	6	10	0
	76	6	9	2	6
	71	2,4,6	17	6	0
	51	8	8	16	0
	34	8	17	7	0
	32	6	6	13	0
Fowey Consols............	100	2,6	5	13	6
	92	2,6	6	4	6
	78	2,6	7	3	0
	75	2,6	7	9	6
West Damsel	71	4,12	4	0	6
	56	8	4	9	6
	55	8,11	2	17	6
	49	2	1	4	6
	46	3	3	10	6
	40	3	5	16	0
Clifford Amalgamated.. (United Mines)	88	4	4	11	0

Mines.	Tons.	Purchasers.	Price.		
Clifford Amalgamated..	66	4	£3	1[illegible]	[illegible]
(United Mines)	36	10,11	1	11	[illegible]
	27	8	3	7	[illegible]
	21	7	10	14	[illegible]
	16	10	2	12	[illegible]
Tywarnhaile...............	65	2	2	14	[illegible]
	46	5,7	2	9	[illegible]
	44	3,5,7	5	2	[illegible]
	43	7	3	14	[illegible]
	42	8	2	[illegible]	[illegible]
Craddock Moor	65	4	7	1[illegible]	[illegible]
	45	5,7	7	1[illegible]	[illegible]
	25	10	3	1[illegible]	[illegible]
Wheal Polmear	60	2,8	4	[illegible]	[illegible]
	50	2	3	1[illegible]	[illegible]
	22	7	7	[illegible]	[illegible]
South Crinnis	66	11	4	[illegible]	[illegible]
	49	8,10	5	1	[illegible]
North Grambler.........	55	2,7	7	[illegible]	[illegible]
Grambler & St. Aubyn	35	8	6	1[illegible]	[illegible]
Great Crinnis	34	2,5,7	3	10	[illegible]
Great Wheal Basset ...	34	6	3	12	[illegible]
Falmouth & Sperries...	26	2,6	3	14	[illegible]
Old Tolgus United	15	2	3	7	[illegible]
North Wheal Busy......	14	7	7	13	[illegible]
East Tolgus	11	12	4	2	[illegible]
North Hallenbeagle ...	11	12	6	7	[illegible]
Creegbrawse	9	6	3	15	[illegible]
New South Ellen.........	7	7	5	7	[illegible]

TOTAL PRODUCE AND VALUE.

	Tons.	Amount. £	s.	d.
Great Wheal Busy	640	1,586	4	0
South Caradon	462	4,406	4	6
Fowey Consols	345	2,258	10	6
West Damsel	317	1,148	13	6
Clifford Amalgamated	254	1,015	3	6
Tywarnhaile	240	777	18	0
Craddock Moor	135	931	7	6
Polmear	132	623	9	0
South Crinnis	115	539	10	0
North Grambler...............	55	400	2	6
Grambler & St. Aubyn......	35	227	1[illegible]	[illegible]
Great Crinnis..................	34	119	1[illegible]	[illegible]
Great Wheal Basset	34	122	[illegible]	[illegible]
Falmouth & Sperries	26	96	1[illegible]	[illegible]
Old Tolgus United............	15	50	1[illegible]	[illegible]
North Wheal Busy	14	107	[illegible]	[illegible]
East Tolgus.....................	11	45	[illegible]	[illegible]
North Hallenbeagle	11	70	[illegible]	[illegible]
Creegbrawse	9	33	1[illegible]	[illegible]
New South Ellen	7	37	[illegible]	[illegible]

EACH COMPANY'S PURCHASE.

	Tons.	Amount. £	s.	d.
1 Mines Royal Co.	—	—		
2 Vivian and Sons	457	£2,440	5	8
3 Freeman and Co.	208¾	787	3	4
4 Grenfell and Sons......	278 1-6	1,641	10	5
5 Crown Copper Co. ...	71½	345	17	1
6 Sims, Willyams & Co.	844 5-6	4,346	5	7
7 Williams, Foster & Co.	219	1,288	0	4
8 Mason and Elkington	376¾	2,476	1	5
9 Bankart and Son	20¾	50	1[illegible]	[illegible]
10 Copper Miners' Co. ...	144¾	[illegible]	1[illegible]	[illegible]
11 Charles Lambert	111¾	[illegible]	[illegible]	[illegible]
12 Newton, Keates & Co.	57¾	258	[illegible]	[illegible]
13 Alkali Co.	—	—		
14 Sweetland & Co.........	71	136	1[illegible]	[illegible]
Total...........	2891	£14,[illegible]	1[illegible]	[illegible]

Average Produce, 6¼
Quantity of Fine Copper, 180 tons 7 cwt.

Average Standard £125 0 0
Average Price per ton £5 1 0

Copper Ores.

Sampled February 19, and sold at Tabb's Hotel, Redruth, March 6.

Mines.	Tons.	Purchasers.	Price.		
Clifford Amalgamated	103	2	£5	12	6
(Wheal Clifford)	102	7	6	18	6
	100	7	7	4	6
	97	7	5	0	6
	96	2	6	16	6
	93	7	3	19	6
	80	2	4	17	6
	61	2	3	17	0
	45	3	6	12	0
West Seton	90	4	7	13	0
	74	5,7	8	17	6
	63	10	2	13	0
	55	4,5,7	9	0	6
	54	10	2	12	0
	50	4	4	15	6
	49	7	5	7	6
	42	7	6	15	0
	35	14	1	0	6
Wheal Basset	88	2	5	15	0
	76	7	6	2	6
	32	7	11	13	6
	23	6	7	3	0
South Tolgus	59	3	4	0	6
	48	4	5	2	6
	45	4	10	16	0
	34	4	9	1	6
	32	4	15	0	6
North Roskear	77	8	8	12	6
(Enys)	23	14	3	0	6
North Roskear (Basset)	50	8	4	11	6
(Pendarves)	25	5,7	5	9	6
	21	5,7	4	12	6
South Frances	67	10	5	7	6
	46	5,7,11	5	8	6
	35	6	7	9	6
	20	3	7	3	6
	9	6	3	15	0
Wheal Seton	21	3	5	11	6
(Pendarves)	72	3	4	12	6
	44	4	6	6	6
	14	2,6	13	10	6
North Crofty	78	5,7	4	15	6
	57	10	0	19	0
East Pool	75	14	4	11	6
	53	3,11	4	5	6
East Basset	49	8	4	16	0
	33	2,6	10	13	6
	26	6	5	10	0
West Stray Park	102	5,7	6	11	6
Condurrow	75	10,11	1	19	0
	25	3	5	4	6
Tolcarne	50	11	3	3	6
	37	4	5	8	0
Tresavean	60	6	2	10	6
Cook's Kitchen	40	6	1	7	0
Crane	16	2	6	12	6
Wheal Emily Henrietta	10	2	6	0	6

TOTAL PRODUCE AND VALUE.

	Tons.	Amount. £	s.	d.
Clifford Amalgamated	777	£4,442	7	6
West Seton	512	2,970	9	6
Wheal Basset	219	1,509	11	0
South Tolgus	218	1,758	16	6
North Roskear	196	1,195	4	0
South Frances	177	1,048	11	0
Wheal Seton	151	917	14	6
North Crofty	135	426	12	0
East Pool	128	569	14	0
East Basset	108	£730	9	6
West Stray Park	102	670	13	0
Condurrow	100	276	17	6
Tolcarne	87	358	11	0
Tresavean	60	151	10	0
Cook's Kitchen	40	54	0	0
Crane	16	106	0	0
W. Emily Henrietta	10	60	5	0

EACH COMPANY'S PURCHASE.

		Tons.	Amount.		
1	Mines Royal	—	—		
2	Vivian and Sons	477½	£2,802	9	9
3	Freeman and Co.	268⅜	1,371	19	3
4	Grenfell and Sons	415 5-6	3,222	19	5
5	Crown Copper Co.	183¾	1,215	11	4
6	Sims, Willyams & Co.	199	948	6	6
7	Williams, Foster & Co.	774⅜	4,887	9	10
8	Mason and Elkington	176	1,126	16	6
9	Bankart and Sons	—	—		
10	Copper Miners' Co.	278½	£794	15	0
11	Charles Lambert	123¾	428	6	11
12	Newton, Keates & Co.	—	—		
13	Alkali Co.	—	—		
14	Sweetland and Co.	133	448	11	6
		3036	£17,247	6	0

Average Produce, 6¼.
Quantity of Fine Copper 207 tons 7 cwts.

Average Standard, ... £123 9 0
Average price per ton, £5 13 6

Copper Ores.

Sampled February 26, and sold at Tabb's Hotel, Redruth, March 13.

Mines.	Tons.	Purchasers.	Price.		
West Basset	78	2,4,7,10,11	£4	17	6
	64	8	4	12	6
	63	10	4	12	0
	62	4	3	11	6
	55	7,10	6	8	6
	47	6	6	13	6
	20	4	14	0	6
	14	9	2	5	0
East Carn Brea	81	10	3	13	6
	79	2,7	8	15	6
	66	11	3	19	0
	57	6	3	19	0
	39	7	10	4	6
	34	10	3	15	6
	11	3	9	7	6
Alfred Consols	55	6	1	12	0
	54	6	2	15	6
	53	14	2	18	6
	43	3	9	10	6
	42	2	1	10	6
	32	2	3	7	6
	25	2	10	9	0
Par Consols	76	7	7	12	6
	75	7	8	5	6
	66	2,3	9	3	0
	33	3	4	11	0
Wheal Margery	66	2	2	12	6
	57	14	2	13	6
	56	2,7	7	9	6
	7	2	13	0	6
Tolvadden	50	6,8	2	10	0
	48	14	3	18	6

Mines.	Tons.	Purchasers.
Tolvadden	44	14
	31	3
	10	8
Copper Hill	54	8
	38	8
	36	4
	32	6
	7	2
Treworlis	67	7
	48	2,6
	21	2,6
Wheal Buller	89	3
	45	8
	1	6
Wheal Agar	45	4
	43	4
	39	4
East Rosewarne	25	2
	24	14
	20	2
	16	8
North Basset	39	8
	38	3
South Crenver	44	14
	19	9
Rosewarne Consols	31	8
	4	2
West Trevelyan	34	4,8
South Carn Brea	19	3
Clijah and Wentworth	15	11
Wheal Trannack	11	6
Wheal Nelson	10	2

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.		
West Basset	403	£2,166	16	0
East Carn Brea	367	2,107	0	0
Alfred Consols	304	1,235	15	0
Par Consols	250	1,954	3	6
Wheal Margery	186	835	10	0
Tolvadden	183	679	3	0
Copper Hill	167	881	4	6
Treworlis	136	713	17	0
Wheal Buller	135	899	19	6
Wheal Agar	127	1,122	19	6

	Tons.
East Rosewarne	85
North Basset	77
South Crenver	63
Rosewarne Consols	35
West Trevelyan	34
South Carn Brea	19
Clijah and Wentworth	15
Wheal Trannack	11
Wheal Nelson	10

EACH COMPANY'S PURCHASE.

	Tons.	Amount.		
1 Mines Royal	—	——		
2 Vivian and Sons	442¾	£3,171	6	0
3 Freeman and Co.	205	1,116	19	0
4 Grenfell and Sons	277¾	2,050	15	6
5 Crown Copper Co.	—	——		
6 Sims, Willyams, and Co.	418½	1,662	17	3
7 Williams. Foster & Co.	367¾	2,794	9	6
8 Mason and Elkington	275	1,627	2	0

	Tons.
9 Bankart and Sons	33
10 Copper Miners' Co.	2211-1
11 Charles Lambert	96¾
12 Newton, Keates & Co.	—
13 Alkali Co.	—
14 Sweetland and Co.	270
Total	2807 £1

Average Produce, 6¾.
Quantity of Fine Copper, 175 tons 10 cwt.

Average Standard, ...£124 12
Average Price per ton, £6 12

Copper Ores.

Sampled March 6, and sold at the Royal Hotel, Truro, March 20.

Mines.	Tons.	Purchasers.	Price.		
Devon Great Consols	125	6	£3	11	0
	119	10	4	4	6
	110	4	9	4	6
	107	12	4	12	0
	104	12	8	1	0
	103	8	4	9	0
	102	10	4	6	0
	97	11	4	4	6
	94	11	3	6	0
	89	11	3	14	6
	84	4	9	4	6
	81	8	4	7	0
	79	4	8	8	0
	75	11	2	3	0
	72	4	11	15	0
	70	6,11	1	6	0
	69	3,7	3	19	6
	68	11	1	5	6
	64	14	2	12	6
	61	4	7	9	0
	60	2	3	2	0
	59	8	4	12	6
	55	11	1	13	0
	51	11	2	19	6
	50	11	0	18	0
	15	4	11	2	6
East Caradon	104	14	5	6	6
	96	6	6	0	6
	80	6	6	3	0
	57	2,6	8	8	6
	42	2	3	0	6
	34	8	16	11	0
Marke Valley	115	11	4	5	6
	90	8	4	19	0
	78	11	3	18	6
	70	5,7	5	10	6
	22	6	2	4	6
Hingston Down	95	2	3	0	6
	81	7,10	2	18	6
	80	2	3	2	6
	57	12	4	17	6
	47	8	6	2	6
Phœnix Mines	85	8	3	7	6
	73	8	3	16	6
	60	6	2	8	6
	50	9	4	4	0
	46	4,6	11	17	0
	12	14	4	7	6
Holmbush	71	2,7	11	15	6
Holmbush	60	4,7	£6	17	6
	58	2,7	12	14	6
	56	4,11	3	5	0
	55	14	2	3	6
Great Wheal Martha	75	14	2	7	6
	70	2,6	1	11	6
	67	2,6	1	9	0
	50	6	3	19	6
East Russell	92	9	3	19	6
	66	11	3	4	0
	54	2,4,6	8	8	6
	36	6	3	19	0
Lady Bertha	110	9	2	1	0
	100	14	3	13	6
	30	7	8	9	6
Bedford United	110	5,7	4	13	6
	108	5,7	4	1	6
Calstock Consols	95	7	4	1	0
	45	11	1	2	0
	40	7,14	2	13	6
Wheal Yarner	127	14	2	16	6
	36	2	5	2	6
Wheal Friendship	91	7	3	17	6
	64	7	10	2	6
Wheal Emma	73	14	4	8	6
	40	2,6	10	9	0
	39	4	2	1	6
Kelly Bray	75	7,8	3	18	6
	54	11	1	3	0
	21	3,8,10	5	6	0
Gunnis Lake (Clitters)	78	7	6	7	0
	42	10	3	10	0
Okel Tor	100	14	2	0	6
	20	4	0	11	6
South Bedford	75	8,11	1	16	0
	20	7	6	3	6
Trehill	40	2,6	1	15	0
	16	2,6	1	7	0
Bampfylde	41	6	18	6	6
Brookwood	35	3,4	5	17	6
	2	4	20	17	0
Gawton	37	8	3	16	6
Hawkmoor	17	3	5	10	0
	14	12	6	6	6
New Cornish Co.	28	9	2	10	6
Fursdon	15	10	5	8	6
Crowndale	12	3	2	2	6
Great Tregune	10	6	9	3	0

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.		
Devon Great Consols	2063	£9,629	18	6
East Caradon	413	3,004	3	6
Marke Valley	375	1,678	19	6
Hingston Down	360	1,340	1	0
Phœnix Mines	326	1,519	4	0
Holmbush	300	2,288	4	0
Great Wheal Martha	262	584	5	6
East Russell	248	117	4	1
Lady Bertha	240	847	5	0
Bedford United	218	954	7	0
Calstock Consols	180	541	5	0
Wheal Yarner	163	543	5	6
Wheal Friendship	155	1,000	12	6
Wheal Emma	152	821	19	0
Kelly Bray	150	£467	15	6
Gun. Lake (Clitters)	120	644	5	0
Okel Tor	120	214	0	0
South Bedford	95	258	10	0
Trehill	56	91	12	0
Bampfylde	41	751	6	6
Brookwood	40	264	19	0
Gawton	37	141	10	6
Hawkmoor	31	182	1	0
New Cornish Company	23	58	1	6
Fursdon	15	81	7	6
Crowndale	12	25	10	0
Great Tregune	10	91	10	0

EACH COMPANY'S PURCHASE.

		Tons.	Amount.		
1	Mines Royal	—	—		
2	Vivian and Sons	621	£3,632	16	0
3	Freeman and Company	307	1,450	1	9
4	Grenfell and Sons	600	4,492	15	6
5	Crown Copper Co.	144	670	11	0
6	Sims, Willyams & Co.	741	3,960	13	9
7	Williams, Foster & Co.	749	4,480	10	0
8	Mason and Ellington	292	1,343	5	3
9	Bankart and Sons	275	£859	5	6
10	Copper Miners' Co.	325	1,325	6	3
11	Charles Lambert	1037	2,911	11	0
12	Newton, Keates & Co.	282	1,695	16	6
13	Alkali Company	—	—		
14	Sweetland and Co.	730	2,377	7	0
	Total	6205	£29,199	19	6

Average Produce, 5¾.
Quantity of Fine Copper, 356 tons 18 cwt.

Average Standard......£120 12s. 0d.
Average Price per ton, £4 14s. 0d.

Copper Ores.

Sampled February 5, and sold at Swansea, February 25.

Mines.	Tons.	Pro-duce.	Pur-chasers.	Price.			Mines.	Tons.	Pro-duce.	Pur-chasers.	P
Cobre	96	11⅝	9	£9	4	6	Californian	64	23¾	7	£20
	95	11⅝	9	9	4	6		60	22¾	8	19
	94	11⅛	1	9	4	6		59	24¼	8	21
	93	11⅝	6	9	2	0		7	20	8	17
	85	11½	7	9	7	6	Seville ore	62	8¾	6	7
	49	21⅛	2,7	18	14	0		6	8⅝	6	7
	47	21⅛	5,10	18	4	6		8	15⅞	6	13
	40	21⅜	3,10	18	15	0		1	24⅛	16	20
	6	58	5	50	0	0	Trump Island	27	7¾	6	6
Californian	76	24	2,7	21	3	0	Bristol Reg.	8	43	5	38
	64	23¾	7	20	18	6	Erin's ore	2	3	6	1

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.				Tons.	Amo
Cobre	605	£7,095	3	6	Trump Island	27	£175
Californian	331	6,878	2	6	Bristol Regulus	8	306
Seville ore	74	566	8	0	Erin's ore	2	8

EACH COMPANY'S PURCHASE.

	Tons.	Amount.				Tons.	Amo
1 Copper Miners' Comp.	94	£867	3	0	10 Mason and Elkington	43½	868
2 Freeman and Co.	62½	1,261	17	0	11 Bankart and Sons	—	—
3 P. Grenfell and Sons	146	2,948	0	0	12 Charles Lambert	—	—
4 Crown Copper Co.	—	—			13 Ravenhead Copper Co.	—	—
5 Sims, Willyams & Co.	37½	1,035	1	9	14 Sweetland and Co.	—	—
6 Vivian and Sons	195	1,571	9	0	15 Bold Copper Co	—	—
7 Williams, Foster & Co.	276½	4,756	9	0	16 Jennings and Co.	1	30
8 Mines Royal	—	—					
9 British & For. Cop. Co.	191	1,761	19	6	Total	1047	£15,025

Copper Ores.

Sampled February 19, and sold at Swansea, March 11.

Mines.	Tons.	Pro-duce.	Pur-chasers.	Price.			Mines.	Tons.	Pro-duce.	Pur-chasers.	Pr
Knockmahon	71	8¾	6	£7	6	0	Berehaven	131	10⅝	3,10	£9
	63	8⅝	6	7	6	0	Springbok	45	41¼	6	37
	59	11¼	6	9	16	0		36	41¾	6	37
	63	10⅝	7	8	19	6	Burnt ores	34	3	7	2
	62	10⅝	6,10	8	19	0	London slags	20	7½	16	6
Cobre	90	10⅛	14	9	0	0		2	21⅝	5	13
	68	10¾	6	9	1	0		1	48	5	41
	48	21⅞	3	19	0	6	Seville ores	56	9½	7	7
	41	21⅝	5,7	18	15	0		1	14¾	7	12
	27	20	3	17	15	0	Eng. and Canad.	18	34	3	30
	10	14¼	16	12	19	6		16	41	2	37
	7	58	5	48	10	0	Mixture	38	7½	1,7	6
	9	14⅝	3	12	10	0					

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.				Tons.	Amou
Knockmahon	318	£2,676	14	6	London slags	23	£200
Cobre	300	4,168	7	0	Seville ores	57	440
Berehaven	131	1,185	11	0	English and Canadian	34	1,150
Springbok	81	3,009	3	0	Mixture	38	240
Burnt ores	34	71	8	0			

EACH COMPANY'S PURCHASE.

	Tons.	Amount.				Tons.	Amou
1 Copper Miners' Comp.	19	£120	3	6	10 Mason and Elkington	96½	870
2 Freeman and Co.	34	1,150	6	0	11 Bankart and Sons	—	—
3 P. Grenfell and Sons	149½	2,097	14	6	12 Charles Lambert	—	—
4 Crown Copper Co.	—	—			13 Ravenhead Copper Co.	—	—
5 Sims, Willyams & Co.	30½	802	11	6	14 Sweetland and Co.	—	—
6 Vivian and Sons	373	5,458	8	0	15 Bold Copper Co.	—	—
7 Williams, Foster & Co.	193½	1,582	1	6	16 Jennings and Co.	30	251
8 Mines Royal	—	—					
9 British & For. Cop. Co.	—	—			Total	1016	£13,142

Lead Ore Sales.

Dates.	Mines.	Tons.	Price per Ton. £	s.	d.	Purchasers.	Amount of Money. £	s.	d.
Feb. 25.	Minera	120	12	15	6	Jones, McNicol & Co.			
	,,	100	12	10	0	W. J. Cookson & Co.			
	,,	100	12	12	6	Walker, Parker & Co.			
	,,	100	12	16	6	Locke, Blackett & Co	6237	13	0
	,,	31½	12	16	6	ditto			
	,,	31½	12	16	6	Jones, McNicol & Co.			
	,,	7	14	10	6	Walker, Parker & Co.			
,, 27.	Westminster	50	12	1	6	Walker, Parker & Co.	603	15	0
	Maesysafn	50	12	5	0	Adam Eyton	612	10	0
	Mount Pleasant	35	12	4	0	Walker, Parker & Co.			
	,,	12	14	2	6	ditto	737	15	0
	,,	5	14	2	6	Adam Eyton			
	,,	5	14	2	6	Walker, Parker & Co.			
	Hendre Ucha	14½	12	3	6	ditto	176	10	9
	Roman Gravels	30	12	15	6	ditto	383	5	0
	Bryntail	11½	12	7	6	ditto	142	6	3
	Wheal Mary Ann	60	25	2	6	Stock & Co.	1507	10	0
,, 29.	Isle of Man Mining Co.	100	23	8	0	Sims, Willyams & Co.	2340	0	0
Mar. 1.	Newtownards	55	12	6	0	Mining Co. of Ireland	676	10	0
	Penpompren	20	13	13	0	Sims, Willyams & Co.	273	0	0
,, 3.	Glogfach	60	15	2	6	Mining Co. of Ireland	907	10	0
	East Logylas	70	12	1	6	Walker, Parker & Co.	845	5	0
	Cwmyswith	100	12	1	6	ditto	1207	10	0
,, 4.	North Minera	30	11	17	6	ditto	356	5	0
,, 6.	Dyliffe	66	12	11	0	ditto	1513	1	0
	,,	55	12	9	0	ditto			
	Dyfngwm	28	12	1	6	ditto	338	2	0
	Llanerchyraur	42	13	12	0	Adam Eyton	571	4	0
	Rhoswydol	10½	11	9	6	Newton, Keates & Co.	120	9	9
8.	Llanfyrnach	20	12	18	0	Sims, Willyams & Co.	258	0	0
10.	Lot 1 (ex *Helena*) Liverp.	50	10	17	6	Walker, Parker & Co.			
	2 ,,	50	10	17	6	ditto	1631	5	0
	3 ,,	50	10	17	6	ditto			
13.	Chiverton	53	17	0	6	R. Michell & Son	1024	3	0
	,,	33	11	1	6	ditto			
	Talargoch (Maesyrerwddu)	58	12	16	6	Walker, Parker & Co.	1098	12	0
	,, (Coetia Llys)	27½	12	18	0	Adam Eyton			
	Deep Level	15	11	14	0	Walker, Parker & Co	175	10	0
	Brynford Hall	5½	11	11	0	ditto	63	10	6
	Herward United	10	10	19	0	ditto	109	10	0
	Rhosesmor	45	11	16	0	Adam Eyton	531	0	0
	Orsedd	10	12	7	6	Walker, Parker & Co.	123	15	0
	Parys Mine	35	12	12	6	ditto	441	17	6
	Long Rake	15	12	5	6	ditto	184	2	6
	Grosvenor	6	11	16	6	ditto	70	19	6
	West Merllyn	3	12	10	0	ditto	37	10	0
	Lady Eleanor	3¼	12	8	6	ditto	40	7	7
	Holywell Level	10	13	13	6	ditto	136	15	0
	Dyliffe	50	12	0	6	ditto	601	5	0
	Dyfngwm	32	11	13	6	Newton, Keates & Co.	373	12	0
	Rhoswydol	26	11	6	6	Walker, Parker & Co.	294	9	0
	Llangynog	15	11	15	6	ditto	176	12	6
,, 17.	Frongoch	90	11	10	6	Panther Co.	2065	10	0
	,,	90	11	8	6	ditto			
	East Darren	70	15	3	6	R. Michell & Son	2707	0	0
	,,	70	14	18	6	ditto			
	Cefn Brwyno	41	12	1	0	Sims, Willyams & Co.	494	1	0
	Cwm Erfin	25	15	0	0	ditto	737	10	0
	,,	25	14	10	0	Panther Co.			

Black Tin Sales.

Date.	Mines.	Tons	c.	q.	lbs.	Price per ton. £	s.	d.	Purchasers.	Amount of Money. £	s.	d.
Feb. 22.	Drake Walls	6	10	0	0	72	0	0	R. Michell & Co.	1318	6	[illegible]
	,,	6	5	0	0	67	12	6	Daubuz & Co.			
	,,	6	5	0	0	67	12	6	Bissoe Company			
,,	Trevenen	5	3	0	14	72	0	6	——	410	9	[illegible]
	,,	0	17	0	6	46	0	0	——			
,, 22 & 27.	Tincroft	9	13	2	17	65	10	0	——	1426	[illegible]	[illegible]
	,,	6	6	1	16	66	10	0	Bolitho & Sons			
	,,	5	7	3	3	70	5	0	——			
,, 28.	Gt. Wh. Fortune	20	2	2	2	—			——	1458	2	[illegible]
,,	Basset & Grylls	18	15	3	27	—			——	1253	5	[illegible]
March 6.	Gurlyn	5	11	3	16	65	10	0	Chyandour	366	9	[illegible]
8.	Penhalls	4	17	0	22	66	0	0	Bissoe Company	320	14	1
	Kitty (St. Agnes)	7	14	0	2	59	0	0	——	454	7	[illegible]
,, 11.	Brea Consols	3	17	0	12	72	0	0	R. Michell & Co.	340	7	[illegible]
	,,	0	17	2	5	61	0	0	——			
	,,	0	4	2	2	41	0	0	——			
,, 12.	Kitty (St. Agnes)	1	7	0	14	59	0	0	Daubuz & Co.	80	4	[illegible]
,, 15.	Garlidna	7	3	2	17	69	0	0	Bissoe Company	590	6	[illegible]
	,,	1	17	3	16	50	0	0	——			
	Gt. Wh. Fortune	15	7	2	15	—			——	1065	9	[illegible]
	Gt. Wheal Vor	22	1	2	26	—			——	1532	3	10
	South Carn Brea	5	15	1	9	62	15	0	Trethellan Co.	727	7	[illegible]
	,,	5	14	3	16	63	12	6	Chyandour			
	Pedn-an-drea	7	19	3	25	—			Bissoe Company	514	5	[illegible]

Tin ores being sold by private contract, the particulars are not generally published or accessible. We hope, however, to be able to provide monthly a tolerably complete list of the sales of this metallic ore: the above list gives no adequate idea of the real sales.

Sundry Copper Ore Sales.

Date.	Mines.	Tons	c.	q.	lbs.	Price per ton. £	s.	d.	Purchasers.	Amount of Money. £	s.	d.
Feb. 7.	Alderly Edge (precipitate)	18	11	1	0	57	15	10	Sims, Willyams & Co.	1778	0	11
,,		12	1	3	0	58	10	0	——			

Sold at Liverpool, by Mr. James Hallows.

Date.		Tons.	Price per ton. £	s.	d.	Purchasers.	Amount of Money. £	s.	d.
,, 25.	Lot 1 (ex *Annie Bragington*)	75	20	4	6	Newton, Keates & Co.	6167	16	3
	2 ,,	75	20	0	6	ditto			
	3 ,,	75	20	3	9	J. Keys & Son			
	4 ,,	75	21	0	0	ditto			
	7 (ex *Polestar*)	70	19	14	0	P. Grenfell & Sons	8225	0	0
	8 ,,	70	19	14	0	ditto			
	9 ,,	70	19	9	0	Sims, Willyams & Co.			
	10 ,,	70	19	5	0	P. Grenfell & Sons			
	11 ,,	70	19	14	0	ditto			
	12 ,,	70	19	14	0	ditto			
March 18.	Parys Mines	350	5	11	6	C. Lambert	1961	5	0

Blende Sales.

Date.	Mines.	Tons.	Price per ton. £	s.	d.	Purchasers.	Amount of Money. £	s.	d.
Feb. 25.	Minera	44	2	5	0	W. Kenrick	202	0	0
	,,	19	2	0	0	ditto			
	,,	19	2	0	0	A. Courage & Co.			
	,,	18	1	10	0	W. Kenrick			

THE

NING AND SMELTING MAGAZINE.

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The Coal Fields of North Wales.

BY EDWARD HULL, B.A., F.G.S.,
Of the Geological Survey of Great Britain.

arboniferous Rocks in Lancashire and Cheshire, which plunge the Triassic and Permian formations along their southern and n margins, again re-appear, rising from beneath these newer in Flintshire and Denbighshire. The great oval plain of New andstone and Marl, enclosed along four-fifths of its circum- by Carboniferous and older Palæozoic Rocks, which occupies eater portions of Cheshire and Salop, may be regarded as very a true basin—with an inlet at the north-west—in the penin- f Wirral, and an outlet at the opposite side, communicating he broad band of the same formation which traverses England Devonshire to Durham—from the English Channel to the North As political economists, we might well regret that so large an robably 1500 square miles, of coal-bearing strata should be saly buried beneath strata of comparatively small utility in to their mineral productions. It has been long a favourite ation amongst geologists more or less versed in the stoney (for, unhappily, like the term "professor," the name of ist is usurped by many who would be hard put to it to es- a title), that the great saliferous basin of Cheshire is a ouse of coal for the supply of future generations. Closer ation, however, leads us to impugn the latter part of this ition, while fully admitting the former. There can scarcely be t that coal does underlie this area. The known succession of ata, and the dip of the Coal-measures in the direction of the of the basin along the west, north, part of the east, and all lead to this conclusion; but the *depth*, as indicated by the ss of the overlying strata, *that* is the question which, when into in detail, obliges us to banish all visions of future es usurping the farmsteads of Cheshire. A very few words obably be sufficient to establish this conclusion.

happens, that the New Red Sandstone attains in this district lopment greater than in any other part of England. The

Bunter, or lower division, has a thickness of 1000 to 1500 feet, while the Keuper, or upper division, is in all probability considerably thicker, falling little short of 3000 feet. If to these we add 2000 feet for Permian and the Upper Coal-measures, which overlie the workable coal-seams, there will be in all from 4000 to 5000 feet of strata superimposed upon the coal over by far the larger portion of this wide-spread plain; at least all that part of it occupied by the upper division of the Trias.

Such being the case, with reference to the greater portion of the Cheshire Basin, it by no means follows that there are actually no spots in which coal may be inferred to lie at accessible depths. On the contrary, we are somewhat sanguine regarding the coal-bearing capabilities of that very important district lying between the extreme south-western margin of the Lancashire coal-field, and the coal-fields of Flint and Denbigh. This embraces the peninsula of Wirral, between the estuaries of the Mersey and the Dee; certain parts of the district east, and south of Liverpool; and the neighbourhood of Chester. The tracts here referred to are composed of the *lower division* of the Trias, and they are traversed by systems of faults,* along which very low beds of that formation are upheaved in certain directions. Some of these faults are up-throws of 500 or 600 feet, and it is evident that displacements of the strata to that amount may one day be found of extreme utility in lessening the depth of the coal-bearing rock. In the author's opinion, there are several localities within short distances of Chester and Liverpool where coal might be reached at depths varying from 400 to 500 yards and upwards.

It unfortunately happens, that several experiments, which have been made for coal in these districts, have been undertaken unadvisedly, and in ignorance of the true sequence of the strata. Thus, instead of the sinkings having been made in the lowest available strata of the Trias, the places selected were situated on beds high up in the series. In one spot, near Warburton, the Keuper shales were mistaken for Permian Magnesian Limestone; and great was the surprise of the workmen when, after passing through these beds, they entered (instead of Coal-measures) the red sandstone of the Bunter. A similar mistake was made at Lymm in Cheshire; and, in a third instance, near Hoylake some miles west of Birkenhead, the place selected for boring was situated in the highest sub-division of the Bunter sandstone, in spite of the fact, that lower beds of that formation lay close at hand and actually dipped *towards* the spot where the experiments was being carried on. In all these cases, failure was the result of ignorance, and should not be regarded as prejudicing the question of the accessibility of coal within the district occupied by the New Red Sandstone. They form a part of a large catalogue of profitless experiments, in which money has been wasted, and only disappointment gained; experiments undertaken at the instance of "practical men," whose verdict—"that it is a likely place for coal"—has been acted upon, while no opinion has been asked of the educated geologist. The aggregate sum thrown away in undertakings

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* These faults are traced on the maps of the Geological Survey, and are likely one day to be found of economic value when the question comes to be discussed as to the best sites for collieries.

of this kind has been calculated as sufficient to pay for the whole cost of a geological survey of the United Kingdom. We trust, however, the days of this ignorance are passing away; that the opinion of a mining surveyor, whose knowledge extends no farther than the borders of a coal-field, will not be considered as entitled to respect beyond that province. The value of theoretical geology is becoming more felt and allowed, and must become daily more indispensable to the success of all projects having reference to water supply, and the raising of coal in previously unproved districts.

The range of Moel Fammau, which forms a conspicuous and pleasing feature when viewed from every elevation of Cheshire and South Lancashire, descends by a series first, of smooth and steep shoulders, then, of terraces and broken ridges, towards the valley of the Dee and the plains of England. The strata arrange themselves in a series of parallel bands, trending generally from north to south, and broken through by several cross fractures, only one of which, however, seriously affects the general uniformity of this meridianal arrangement of the rocks. This great fracture, which here has caused the severance of the Flintshire from the Denbighshire coal-field, is one of the most remarkable in Britain, as it has been traced for a distance of about sixty miles along the northern basis of Cyrn-y-Brain, through Bala Lake to the coast of Merionethshire. It has apparently been produced previously to the Triassic period, as it is lost beneath this formation a little to the south-east of Hope, without producing any apparent displacement of the beds. It ranges a little north of east, and on the north side the beds of Millstone Grit and Carboniferous Limestone are upheaved, and the Coal-measures nowhere reach across from the Denbigshire side to that of Flintshire.

The general direction of the dip of the Coal-measures in both coal-fields is easterly; and they are alternately covered over by Permian and Triassic formations, which form the boundary of the coal-fields along a line running nearly north and south from the river Dee near Broughton to Oswestry, passing by Wrexham and St. Martin. The Permian strata are composed of red and purple marls and sandstones, dipping in the same direction as the Coal-measures. Under them the coal-seams dip, and may one day be followed; but probably never very far, as they are of great thickness, and dip rather steeply.

Of the Coal-measures, we shall presently speak more in detail. It is here their nature, as elsewhere, to form a tract of depressed and rather level ground. The strata are generally concealed by an enormous accumulation of Drift-deposits, consisting principally of gravel with boulders; so that, except in the deep river-courses, they are seldom visible.

In the centre of the Flintshire coal-field the beds are spread out to a breadth of about six miles, principally through the agency of faults which repeat the beds several times successively from east to west. In Denbighshire they contract in breadth, and gradually arrange themselves into the form of a solid compact mass, narrowing to a point a short distance south of Oswestry. Here they are completely overlapped by the Triassic and Permian rocks, which pass over the beds, and abut upon the Carboniferous Limestone. The Coal-measures again appear on the south of the valley of the Severn at

Alberbury, and form a narrow belt extending to Haughmond Hill, near Shrewsbury.

The rising ground to the west of the coal-fields marks the position of the Millstone Grit, which forms one of the meridianal bands of elevated and broken ground already spoken of. The thickness of this series varies from 1000 to 1500 feet, decreasing from north to south; it contains one or two seams of workable coal. Beyond its westerly margin is a parallel band formed of Carboniferous Limestone, this formation frequently presents in strong relief those terraces which distinguish it in its outward aspects from the neighbouring strata. The beds of partially bare limestone may be observed rising from beneath each other in succession, and ending off in abrupt faces of cliff. In the heights above Llangollen this feature is particularly striking, and the author has a vivid recollection of the effect produced on his own mind, when for the first time he caught sight of those mighty walls of grey rock ranging for several miles from north to south, tier above tier, appearing like colossal breastworks thrown up by some race of Titans to defend the plains of England from the warriors who peopled the mountains of Wales. In truth, however, the work is too stupendous for any race of gods or men. The architects were the Polypes of the deep, and those walls were shaped and chiselled by the waves of old Atlantis, which once chafed and flung themselves against their bases.

The Carboniferous Limestone is of special interest to the mineralogist, as being the repository of several systems of mineral veins. The tract of country from the sea-coast near Rhyl to the north of Llangollen has for many centuries been the site of mines from which argentiferous galena, calamine, and blende have been extracted. From the discovery of stone-headed hammers in some of the old works of this part of the country, it is probable these operations were commenced in the time of the ancient Britons; that they were worked in the Roman times is certain, and the present yield, according to the returns collected by Mr. R. Hunt, for 1860, are as follows:—

	DENBIGHSHIRE.	FLINTSHIRE.
Lead ore	6,182 tons 9 cwts.	4,947 tons 19 cwts.
Lead	4,714 „ 3 „	3,767 „ 10 „
Silver........	16,661 ozs.	31,092 ozs.

The lodes in this district, as laid down on the Maps of the Geological Survey by Mr. Warington Smyth, appear in greatest number at the junction of the Millstone Grit and Carboniferous Limestone, including strata of both formations. Many of the lodes are faults, and they range generally across the strike of the beds—that is to say, approximately from east to west. In the direction of Holywell, there are great beds of chert intercalated with the limestone, and the lodes in this position are generally very productive. One of the most remarkable lodes in this district is the "Great Minera Vein," the most productive in North Wales. It is a fault ranging northwest, and having a down-throw to the north-east of about 350 yards. It has been worked from very ancient times, and in 1860, yielded upwards of 4000 tons of lead ore, and 1125 tons of zinc ore (blende). This great fracture enters the Denbighshire coal-fields, and probably produces important changes in the strata; its effect, however, has

been ascertained, as the strata are not yet explored in tion of its prolongation. Besides the lodes already to, there are several remarkable longitudinal fissures g the limestone in the direction of the strike from south. They cut down through the strata to a great own depth, and are filled with rubbish; they are not metalliferous. One of these, called the "Catshole cross has been traced for a distance of twelve miles from Holy- wards, and at its northern extremity it becomes a lode.*

w proceed to the more immediate subject of this article— iption of the coal-fields themselves; having laid a founda- his superstructure by the above somewhat desultory account ks which immediately underlie the coal-formation.

intshire and Denbighshire coal-fields were originally con- ith each other, as they each present a similar succession of d the coal-series of each is almost identical. Of the two Denbighshire is by far the most economically important, from its greater area, but on account of the arrangement of . While the coal-seams in Flintshire are repeatedly dis- nd thrown out by faults, which almost invariably prevent ining great depths,—those of Denbighshire, for the most steadily eastward, and are covered over by conformable der which they may eventually be followed to the limiting coal-mining. From this it arises, that while the one is pproaching exhaustion, the other is practically inexhaus-

FLINTSHIRE COAL-FIELD.

ward, the boundary of the Flintshire coal-field is the estuary ee—westward and southward, the Millstone Grit. From of Air to Bagillt, near Flint, there occurs a narrow band, s interrupted, of Coal-measures, in which there are a few one of which has an air-shaft about a mile out from the f high water mark. We are not certain whether it is at n use. From Bagillt, southwards and south-eastwards, he main area of the field. A large portion of this, extend- the shore inwards towards Northop, is composed of Lower sures with only thin seams. The most important tract is ch stretches from Mold to Hawarden and the Dee, and ds to Treiddyn. Nevertheless, such is the dislocated state ds, that nearly all the thick coals are thrown out three or s in succession, after having "set in" along certain bands y stretching north and south. The depth over these bands where great, much of the coal has already been raised, and ittle prospect of the discovery of large tracts of new ground, sinking over the wide tract of alluvium which borders the

neral succession of the coals, and their intervening strata central part of the coal-field, is very well illustrated by ring section taken at Rhyd-y-Craliad Colliery,† near Mold.

ap of the Geological Survey, 79 S.E.; also Horizontal Section, sheet 43.
the "Explanation" of Horizontal Section of the Geological Survey,
The section above given is abridged from the original.

COAL-SERIES NEAR MOLD, FLINTSHIRE.

	Yds.	Ft.	In.
Strata, principally black shale	6	2	0
Four-feet Coal, with a band of cannel at bottom	0	4	0
Strong black shale	1	0	0
Light blue shale	1	0	2
Black-band Ironstone	0	0	10
Light blue shale with sandstone	1	2	6
Sandstone with shale	2	0	0
Shale with ironstone	0	2	6
Light blue shale with sandstone	5	2	6
Bind Coal	0	2	6
Light blue shale with ironstone	6	1	0
Sandstone with blue shale	4	1	0
Sandstone, very hard (Hollin Rock)	2	2	0
Strong blue metal (shale)	4	0	0
Hollin Coal, in three beds	2	0	6
Cannel	0	1	6
Strong blue shale	2	2	0
Shale, with three beds of ironstone	0	2	0
Blue shale	1	1	0
Sandstone and shale	1	0	0
Strong blue shale (good roof)	3	0	0
Brassy Coal	1	0	0
Shale	13	0	0
Sandstone	8	0	0
Shale	4	0	0
Main Coal	2	1	0

The *Main Coal* is everywhere a most valuable seam. Though only seven feet in thickness at Mold, it becomes as much as eleven or twelve feet in the direction of Hawarden, and is even thicker at the new colliery recently commenced there. At Bryn-ffymon, a four feet coal has been worked, which is supposed to lie sixty-five yards below the *Main seam.* The *Cannel* seam, recently opened up at Leeswood, but which, I am assured by Mr. P. Higson, jun., who is well acquainted with the district, has been worked many years since, and was known to the miners as a sort of black bass, having a marvellous power of blazing when ignited, lies about 100 yards below the *Main Coal.* It is probably identical with the *Four-feet* seam mentioned above, as there is good evidence for believing that it passes into a seam of ordinary coal in other districts. At Leeswood, however, it occurs as one of the most valuable seams of cannel in the kingdom, yielding, in its lower part it is said, 1500 or 2000 cubic feet of gas per ton more than the celebrated cannel of Wigan. It is probably rich also in mineral oil. The following is the section at Leeswood:—

SECTION THROUGH THE CANNEL SEAM AT LEESWOOD.

	Yds.	Ft.	In.
Black shale	3	2	8
Light shale	0	0	7
Black bass, called "slag"	0	0	7
Top cannel	0	2	2
Curly cannel	0	1	8
Bastard do.	0	1	5
Black shale	0	3	0

It may prove worth the while to proprietors, who possess property over this field in which the *Main Coal* has been worked, to ascertain,

boring, whether a seam, calculated to bring so large a profit as s, may not exist under their estate. Of its great value for the oduction of gas there can be no doubt.

At the base of all these coal-seams there occurs a considerable ckness of strata, principally shales, belonging to the Lower Coal-asures, and resting upon the Millstone Grit. The seams they ntain are thin, and rarely worked.

The area of the Flintshire Coal-field is about 35 square miles. ore than half the original quantity of coal has either been raised destroyed, leaving about twenty millions of tons for future supply. 1860, there were 590,500 tons of coal raised, so that, *at the present* e of production, this supply would only last for about 35 years. e number of collieries in work in the same year was 40.

THE DENBIGHSHIRE COAL-FIELD.

The northern extremity of this coal-field terminates along the at fault already described, about one mile south of Hope. Leav- this line, and gradually receding from it, the base of the Coal-asures bend round southward by Minera, and thence takes a due therly course, crossing the Dee at Pont Cysyllian, where the ata are traversed by a large fault, and extending thence to fonen, south of Oswestry. Its length is about eighteen miles, l its breadth, at Wrexham, about four and a-half miles. Towards southern extremity, it contracts considerably—probably from two ses: first, the overlapping of the New Red Sandstone; and ondly, from the gradual thinning of the strata in that direction.

Throughout its whole length the dip is easterly, and the inclina-n generally lessens towards its eastern margin. Nowhere, except the immediate neighbourhood of faults, is the dip very steep—the rage being about 10 degrees. Along the valley of the Alyn, near esford, the dip of the Upper Coal-measures varies from 5° to 10°. is is also the dip in and around Ruabon, Wynnstay, and on the south ik of the Dee; and, as most of the seams are at accessible depths ler these tracts, they are calculated to become of extreme value for ure supply, although still unbroached. The general structure of s coal-field may be expressed by the accompanying section drawn oss the noble escarpment of Cefn-y-Fedw, and the town of abon.

The general series of the main portion of the Denbighshire Field s follows:—

Permian Strata.—Probably attaining a thickness of 2,000 feet, consisting of interstratified red, purple, and brown sandstones (sometimes calcareous) and marls. These beds are well shown in the River Clywedog near Wrexham, and in the Valley of the Dee between Plas-yn-coed and Eyton Hall.

Upper Coal-measures.—About 1,000 feet in thickness. They consist of greyish and yellow sandstones, with coal-plants, interstratified with red and grey clays and shales. There are a few very thin coal-seams, but never of workable thickness. This series is well shown along the banks of the Alyn, from Gresford westward, also around Ruabon, Wynnstay, along the Dee, near its junction with the river Ceiriog.

Middle Coal-measures.—About 800 feet in thickness. Consisting of grey and yellow sandstones, clays, shales, with bands of valuable ironstone and beds of coal. Over these strata the principal collieries are situated.

Lower Coal-measures.—About 1,000 feet in thickness. Consisting of shales and sandstones, with a few thin seams of coal.

SECTION ACROSS THE DENBIGHSHIRE COAL-FIELD.

S. Silurian Schists, contorted. L. Carboniferous Limestone. M. Millstone Grit.
C. Middle and Lower Coal-measures, with Coal-seams. D. Upper Coal-measures.
E. Permian Strata.

e coal-series is very similar to that of Flintshire. At this rthern extremity the strata present the following section, taken at estminster Colliery:—*

COAL SERIES AT WESTMINSTER COLLIERY.

	Yds.	Ft.	In
Top stinking Coal (bad quality)	1	1	0
Strata	70	0	10
Bottom stinking Coal	1	1	6
Strata	10	0	0
Smith Coal	0	2	2
Strata	12	1	6
Drowsall Coal	1	0	0
Strata	9	0	8
Powell Coal	1	0	8
Two Yards Coal	2	0	0
Strata	9	1	8
Crank Coal	0	2	8
Strata	11	0	0
Brassy Coal	1	2	0
Strata	10	2	6
Main Coal (with partings of shale)	2	1	5

may recognise a similar succession in the following section n at Ruabon,† though under different names, and somewhat red circumstances:—

COAL SERIES AT RUABON.

	Yds.	Ft.	In.
Rough Rock (sandstone)			
Footrell Coal	1	0	0
Strata	42	0	0
Whithurst Coal	2	1	0
Strata	44	0	0
Warras Coal	0	2	0
Strata	8	0	0
John o'Gates Coal	in several beds		
Strata	30	0	0
Coal and Cannel	variable		
Strata	29	0	0
New Coal	1	2	6
Strata	13	0	0
Three Yards Coal	2	2	0
Strata	21	0	0
Brassy Coal	0	2	9
Strata	84	0	0
Upper Yard Coal	1	0	0
Strata	1	0	0
Red Coal	.0	1	8
Strata	9	0	0
Stone Coal	0	2	6
Strata	31	1	6
Lower Two Yard Coal	2	0	0
Strata	27	1	6
Coal (very good quality)	0	2	0
Strata	25	0	0
Llwyneinion Coal	0	1	8

on-stones.—The iron-stones of this coal-field have long been wn for their richness and abundance, and are largely employed in

For which the author is indebted to Mr. Napier, the manager. The above is what abridged from the original.
For which I am indebted to Mr. P. Higson, jun., of Manchester.

the Brymbo, Frood, and Ruabon Iron Works. They occur both as "clay-band" and "black-band" ores, and occur in the following positions:—In the upper beds, which lie between the upper and lower sulphurous coals, there are several bands, none of which, I believe, are worked. About 15 yards below the lower sulphurous coal there is a band 9 inches thick, and another 6 inches thick a little above the Drowsall Coal. Above the Brassy Coal, there are shales with several thick bands; and below it, several valuable bands which give the following section at Westminster Colliery:—

	Yds.	Ft.	In.
Brassy Coal	1	2	0
Bass	0	1	6
Clunch	1	1	9
Ironstone	0	0	3
Clunch	0	3	6
Ironstone	0	0	4
Shale	0	1	9
Ironstone	0	0	4
Shale	0	2	0
Ironstone	0	0	9
Shale	0	1	9

At 5 yards under these, are several more thick bands. The next, and perhaps most important, band, is the "Main Coal black-band ironstone," 18 inches thick, lying about 7 yards above the Main Coal. Many of these ironstones contain bi-valve shells. In Denbighshire, there are blast-furnaces at Ruabon, Plaskynaston, Plas Issa, Frood, Brymbo, Leeswood, Ponkey, Dolydd; in all fourteen, but of these only eight were in blast during the year 1860.

Resources.—The Denbighshire coal-field is far from being developed to the extent of which it is capable. In fact, we may affirm that, at least one-half of it, is practically unexplored; yet we have seen with what fine seams of coal and ironstone it is stored throughout. The collieries are generally placed in groups in certain districts; which may be stated in general terms to be—the north, the centre, and south of the field; but between these *foci*, there are considerable tracts with no collieries, at least until very recently. The construction of the Shrewsbury and Chester Railway has given an impetus to mining speculation, but not to the extent which might have been expected.

One reason to which this comparative neglect of mining operations may undoubtedly be traced is—the depth of the superficial drift which covers a large portion of the district, completely concealing the nature of the strata, even in deep river-channels. This is particularly the case to the west and north of Wrexham, and from the banks of the river Ceiriog to Oswestry. It consists, in this country, of a great accumulation of gravel, formed principally of fragments of rock derived from the neighbouring Welsh mountains. This sort of material forms a great impediment to sinking shafts, owing to the water it contains; and as it, moreover, renders the mineral character of the strata obscure, people are unwilling to risk capital upon doubtful investments.

The area of the Denbighshire coal-field is 47 square miles, and it originally contained 727 millions of tons of coal down to a depth of

3000 feet, of which, probably one-tenth has now been raised.* The production of coal is steadily, indeed rapidly, increasing—reaching, in the year 1860, 1,139,500 tons from 39 collieries, as against 527,000 tons in 1858.† Had it not been for the recent depression in trade, the amount raised would, in all probability, have reached a much higher figure. Even at this rate there is enough coal to last for upwards of 400 years.

As compared, therefore, with the Flintshire coal-field, the resources of this field are great indeed; for, notwithstanding the recent re-discovery of the cannel seam there, we may, with much confidence, assert that the coal-field of Flintshire will be exhausted in about half a century.

On the Mexican Method of Amalgamation.

By James Napier, Jun., F.C.S.,

Late Chemist and Assayer of the Guanaxuato Mint, Mexico.

§ V.—THEORY OF THE PROCESS.

Having now given a brief sketch of the mode in which the Mexican amalgamation is carried out, I shall pass on to consider what chemical action takes place in this most interesting process. Before doing so, however, let us consider for a moment two terms—*heat* and *cold*, used in these papers.

Heat and Cold.—There are two kinds of heat: one is caused by there being added a superabundance of magistral; the other is induced by cold, and is called "*calor de frio.*" These differ only in cause, the result in both cases being the destruction of mercury. If a *hot* torta be heated by artificial heat, the chloride of mercury will act on the sulphide of silver in the same manner as the chloride of copper, forming chloride of silver and sulphide of mercury.

On cold mornings the tentaduras, or samples, often show signs of heat, in which case the action is called *calor de frio*—heat from cold; but, as the day advances, and the sun begins to act on the torta, the effect passes off. In the winter season, a somewhat less quantity of magistral is necessary for carrying on the operation than in the summer months: the amalgamators begin to decrease the quantities of magistral about the beginning of September.

When a torta becomes hot from the use of a superabundance of material, a quantity of wood ashes or lime is added for the purpose of decomposing the excess of chloride of copper; and, as I have also before stated, copper precipitate is used for cooling a torta, which it effects by reducing the excess of bi-chloride of copper to proto-chloride.

The term *cold* simply implies that the operation is not going on so fast as it ought, and that a sufficient quantity of magistral has not been added; if the torta be allowed to remain long in this state, a large quantity of mercury is apt to be lost in the form of oxide.

Theories of the Process.—According to Sonneschmidt, the only theory which the Amalgamators had before his time was, that the

* *Coal-fields of Great Britain*, Second Edition, p. 101.

† *Mineral Statistics of Great Britain*, for those years respectively.

salt cleaned the silver, the magistral heated it, and that both reduced it to the metallic state so as to combine with the mercury. They were also aware that, for each ounce of silver produced there must be lost an equal weight of mercury; but *why* this should be so, was a problem they could not solve, and all mercury lost beyond this they considered mechanical.

Sonneschmidt's Theory.—Sonneschmidt after many years of practice and careful experiment, published a most valuable treatise on the various methods practised in Mexico for the reduction of silver ores, and lays down for the patio amalgamation his theory, which may be briefly stated as follows:—

The ingredients added to a torta, are salt, magistral (sulphate of copper), mercury, and sulphide of silver. The salt and magistral act on each other, and form a bi-chloride of copper and sulphate of soda; the bi-chloride of copper next acts on the sulphide of silver, forming chloride of silver, which is dissolved in the excess of salt added; and the silver is next reduced to the metallic state by the mercury forming calomel and amalgam. This was Sonneschmidt's theory, which to the present day is almost universally received as the true one. However, since his time it has been further shown, that the proto-chloride of copper, formed by the action of the sulphide of silver on the bi-chloride, is dissolved in the excess of common salt, and acts on another portion of the sulphide of silver, reducing it to the state of chloride to be acted on by the mercury, and be converted into amalgam. It has also been shown very satisfactorily by Boussingault, who has devoted some time to the subject, that the copper of the sulphate is ultimately converted into a sulphide by the following equation:—

$$Ag\,S + 2Cu\,Cl = Ag\,Cl + S + Cu_2\,Cl. \text{ then}$$
$$Ag\,S + Cu_2\,Cl = Ag\,Cl + Cu_2\,S.$$

Sulphide of mercury is also at times found in tortas, and it has been supposed that this is formed by the calomel acting on the sulphide of silver, giving chloride of silver and sulphide of mercury; but may it not be formed, as in the arrastres, by the direct action of the mercury on the sulphide of silver? Some amalgamators suppose that the copper is ultimately converted into oxychloride.

Bowring's Theory.—In 1848, Mr. John Bowring, who has had much practice in the patio amalgamation, as carried on in Mexico and Peru, read a paper before the British Association, in which he denied that chloride of silver was formed at all in the process. His principal reason was founded upon experiments made in *Guadalupe-y-Calvo*, in Mexico, where he states, chloride of silver could not be found even after leaving the tortas in the patio in working order for the space of four months. In 1858, Mr. Bowring also published a pamphlet in Mexico defending the same idea; and describing, as he likewise did in the paper mentioned, a new theory, the basis of which I translate from his pamphlet:—

"It is," he writes, "well known, that the materials which are employed in the reduction of the sulphides of silver, consist of salt, sulphate of copper, and mercury; and that, by employing only two of these ingredients, nothing will take place. I mixed the three in an appropriate vessel, and found that the mercury combined with half

of the chlorine contained in the bi-chloride of copper, and thus formed a proto-chloride of both metals. This combination of the latter metal—copper—has the property of absorbing oxygen; hence, we may suppose, that this element is the principal agent in the operation. I made some proto-chloride of copper, tried it in the patio, and obtained a good result.

"According to the theory which this mode of treatment establishes, the bi-chloride of copper gives an atom of its chlorine to the mercury, and both metals are converted into proto-chlorides; the chloride of copper absorbes oxygen, which combines with the sulphur of the silver, forming sulphuric acid, and leaves the silver in a metallic state to amalgamate.

"The sulphuric acid formed by the sulphur of the silver and the oxygen of the proto-chloride of copper, decomposes the common salt, and the chlorine disengaged in this way may combine in either of the two following methods:—1st. With the protochloride to form again a bi-chloride. 2nd. With the chloride of the protoxide of copper, which, absorbing another equivalent of oxygen, passes to the state of oxychloride, or chloride of the peroxide. According to my mode of thinking, the protochloride of copper produces in the beneficio (amalgamation) an effect analogous to nitrous acid in the manufacture of sulphuric acid. It is easy to imagine that the protochloride of copper, after it has absorbed oxygen from the air and water, and given it up to the sulphur, will return to repeat the same operation."

Mr. Bowring then gives the following proofs of his theory:—

"I. Dissolve, in a glass or porcelain vessel, salt and a small quantity of sulphate of copper, with this mix some mercury, and at the end of a few hours there will result a white powder which is proto-chloride of mercury: filter the solution, and precipitate the copper with caustic soda or potash. The orange colour indicates a salt of the prot-oxide; and if care be taken to gather on a filter the white powder, it will, in contact with caustic soda and ammonia, be converted into the prot-oxide of mercury, which may be known from the black colour it assumes. If the solution of proto-chloride of copper be left exposed to the air for a longer time, there will form on the surface a yellowish green crust, which is a chloride of the prot-oxide of copper.

"II. Beneficiate (amalgamate) a small quantity of ore, containing sulphide of silver, with salt, and bi-chloride of copper chemically pure; at the conclusion of the operation add distilled water; filter, and precipitate the solution with nitrate of baryta; when it will be found, that there has been a formation of sulphuric acid equivalent to the sulphur which was combined with the silver. It is to be noted that this sulphuric acid could not have been formed without the presence of oxygen, which, without doubt, resulted from the absorption of this gas by the proto-chloride of copper.

"III. Amalgamate silver ore with bichromate of potash and sulphuric acid (it is known that the chemical action of these two latter on each other is to evolve oxygen), and it will be found that there is formed an amalgam of silver. In the same way, any materials which produce oxygen may serve in the amalgamation.

"IV. Take the amalgam of a tentadura (sample) of a torta which

is in good working order, that is in such a condition that when the amalgam is pressed with the finger it gives out a white powder; dissolve this in pure nitric acid, and wash afterwards with distilled water, when it will be found that the white powder which remains is a protochloride of mercury." Again, in the same pamphlet, Mr. Bowring states: "The difficulty there is in working ores containing chloride of silver (like those from the district of *Catorce*) demonstrates clearly the nonfoundation of the formation of chloride of silver in the common patio amalgamation." Thus, we have Mr. Bowring's reason for rejecting the theory of Sonneschmidt, and denying that chloride of silver is formed, and also the theory of his own which he proposes to substitute.

Uslar's Experiments.—In 1853, Dr. Uslar published a pamphlet in Mexico, comparing the patio with the barrel amalgamation, in which he, like Mr. Bowring, denies that chloride of silver is formed in the patio. He argues, that if the silver were converted into chloride, some other metal, such as copper, might be substituted for the mercury until the whole of the silver was reduced to the metallic state; and he instituted experiments to prove that such would not answer. Thus he introduced into a torta a superabundance of materials—salt and sulphate of copper, and some metallic copper. The result obtained was, no silver reduced, and the conversion of the greater part of the metallic copper into chloride. The next experiments were made with a view of protecting the mercury by copper or iron. The results were:—where iron was used, there was no amalgamation at all, the mercury coming out as it went in, without amalgam; but, where copper was present, the result was different, the amalgam containing a large quantity of copper with but little silver. The conclusion drawn by Dr. Uslar from the above experiments was, that the presence of other metals is against the amalgamation.

In a third series of experiments, there was put into the torta double the usual quantity of salt; in two days afterwards the magistral was added, and the whole trodden at intervals during fifteen days. Then iron was added, and the mass again trodden; and two days after this the mercury was added; but the torta showed no symptoms of entering into amalgamation, and after remaining eight days longer in the patio, and being trodden daily, the mercury was taken out as it was put in, without amalgam. Hence, Dr. Uslar comes to the conclusion that it is not true that chloride of silver is formed by the salt and sulphate of copper, and reduced by the mercury; because, with the extra quantity of materials, chloride of silver ought to have been formed,—the iron ought to have reduced it more rapidly than the mercury, and amalgam ought to have been formed; but nothing of the kind took place. He also argues, that as ores, containing native chloride of silver, cannot be worked by the patio amalgamation, it therefore cannot be *formed* by it. However, Dr. Uslar, unlike Mr. Bowring, proposes no new theory.

Consideration of the Theories.—Having now stated the various opinions generally entertained regarding the theory of this process, I shall venture a few remarks which may not prove altogether uninteresting, and may help to throw some further light on the subject.

An apparently very strong argument used by Bowring and Uslar against chloride of silver being formed in the patio amalgamation is, that native chloride of silver, according to them, cannot be worked by that process. This might even be quite true, and yet chloride of silver be *formed* in the process; for we have only to consider the physical properties of the native chloride, to take a different view of the matter. It is a very hard horny substance, which, even in ammonia—probably its best solvent—will take some time to dissolve. Now, in a torta, the solution of salt is comparatively weak; it is also cold, and will dissolve but a very small portion of the newly-formed chloride; but of native chloride (or horn silver), I question much whether the usual strength of the salt in a torta would be strong enough to dissolve *any*. Mr. Edward Louckner* has often assured me that horn silver can be reduced very well, in fact, better than any other compound, in the patio, providing that great care be taken in the grinding, so as to have it in the smallest possible state of division, and that an excess of salt be added in the operation.

Another argument used by Dr. Uslar, to prove that chloride of silver is not formed in a torta is, that if such were the case, it ought to be precipitated or reduced by another metal, such as copper, or iron, previous to adding the mercury.

Now, metallic silver can be produced from the sulphide by various methods; but there is a great difference in the ease with which silver produced by such different methods will combine with mercury. If, for instance, metallic copper, in the form of precipitate, with a little salt as an exciting agent, be added to an ore containing sulphide of silver, metallic silver and sulphide of copper will be the result. This result will be more or less perfect, according to the conditions under which the experiment is made. If the ingredients be ground in a mortar, the result will be rapid; but if mercury be now put with this, it will form amalgam but very slowly indeed, unless heavy friction be used. On the other hand, native silver, and metallic silver, formed by precipitation from the sulphate by copper, or by many other means, will amalgamate with greater ease; so that the silver in Dr. Uslar's experiments might actually have been reduced to the metallic state, but would not amalgamate in the torta; and such probably was the case. I have repeated these very experiments of Dr. Uslar on a smaller scale; that is to say, I took the usual proportions of salt and sulphate of copper, and mixed with them moderately rich silver ore. After these had remained in contact for about twelve hours—part of the time exposed to a tropical sun—the experiment was divided into two portions; to one was added a small

* Mr. Louckner, whom I have before had occasion to mention in these pages, was a gentleman of the highest scientific attainments, and had studied closely, for upwards of thirty years, every thing connected with the reduction of silver ores in Mexico. He had also written what, I have no hesitation in saying, would have been the most valuable treatise which has yet appeared on the subject, but which, I regret to state, is lost to the world. In 1855, Mr. Louckner was travelling from Angangueo to Guanaxuato, having with him his MSS. At a certain part of the road he was attacked by robbers; and, on attempting to defend himself, his pistols missed fire. He was then overpowered, robbed, severely wounded, and left on the highway for dead. When he recovered himself, he found his papers and MSS. torn and scattered to the winds. Mr. Louckner died four and a-half years afterwards in Guanaxuato.

slip of very bright etallic mcopper, and to the other a piece of polished iron. Almost the moment the copper was added, it became coated with a white precipitate of silver; silver was also precipitated on the iron, but not until it had been in contact for some time. Again, if we take into consideration the small proportion of metallic silver there is in a torta, compared to the enormous amount of earthy matters present; and also the small amount of mercury, and that the two metals would have to be brought into actual contact before they could combine; it would, I think, have been rather strange had amalgam been formed. It is not enough that silver and mercury be brought in contact with each other to make them combine; but, in many cases, it requires heavy friction; and in a thick pasty mass like a torta, the difficulties would be much increased. When the chloride of silver is in solution in common salt, then we have a chemical action going on by which we can better understand why amalgamation takes place.

The next argument used against the formation of chloride of silver is founded on the fact, that it had failed to be detected in tortas which had been left in the patio for months, without mercury I presume. The following experiments made by myself may entirely account for this:—

The first experiment was on pure sulphide of silver. To this was added a small portion of bi-chloride of copper and salt, and the result was an abundant formation of chloride of silver.

The next experiment was made with common silver ore of moderate richness, which, besides sulphide of silver, contained also sulphides of iron. To this were added the usual quantities of sulphate of copper and salt, and the result was, that chloride of silver was formed after a few hours' standing; but, at the end of three days, I was surprised to find that the whole of the chloride of silver had again disappeared. The experiment was prolonged for three weeks, and tested daily for chloride of silver, thinking it might reappear; but it did not. This experiment was repeated at various times, and with different ores; and in every case chloride of silver was formed, but in some instances only did it disappear on standing. I may here observe that the chloride of silver held in solution at one time in a torta must necessarily be very small, from the fact that the quantity of salt *used* is only sufficient to hold a very small quantity in solution at once; so that in making such experiments as the above—unless the ores used be very rich, and a large excess of salt be added—one must not expect to obtain an abundant formation of chloride, but rest contented with finding a moderate proportion, as the process is one which goes on but very slowly indeed.

It became a question why the chloride of silver, when once formed, disappeared again? This I tried to discover by numerous experiments on a small scale. In tortas, where large quantities of sulphide of iron, particularly of the white variety, was present, the chloride of silver was decomposed, and chloride of iron formed; the silver being again probably converted into sulphide.* Sulphides of copper had no action on chloride of silver. Where galena was pre-

* With artificial sulphide of iron, chloride of silver is very rapidly decomposed, particularly when heated.

sent, the chloride of silver was very rapidly decomposed, and chloride of lead formed. Blende had a similar effect; and this may explain why in *Zacatecas*, and some other districts where the ores contain blende, and sometimes small quantities of galena, they are obliged to use an excess of magistral for the purpose of first decomposing these sulphides. We are also aware that if sulphate of copper and salt be added to galena or blende, that chlorides of lead or zinc would be formed; and there are, doubtless, many local actions taking place in tortas, which may vary very much with the nature of the ores operated upon. I have withheld many experiments made on a small scale on the subject; believing that it is only by close attention to the many various changes which take place in the tortas themselves, that a true knowledge of the theory of the patio amalgamation can be arrived at, and that laboratory experiments often only tend to lead us astray, unless corroborated by actual results on a large scale.

To prove further the formation of chloride of silver in the operation, I have obtained numerous samples of tortas in actual operation, after the salt and magistral had been added, but before the addition of the mercury. In every case did I find chloride of silver; and even when the mercury was present, in tortas far advanced, chloride of silver was always found. My general method of testing was to digest the sample for a short time in a solution of hot common salt; then filter, and add to the filtrate a clean piece of copper, upon which the silver was precipitated. In some cases the sample was digested in weak ammonia, filtered, and an acid added to the filtrate, which precipitated the chloride of silver.

From what has been said, it is very evident that, at the commencement of the amalgamation, there must be a considerable quantity of free chloride of copper present; because the whole of the ingredients necessary to carry on the operation to the end are added at once, and yet the torta does not become *hot*—provided of course the ingredients have not been added in excess. How is this? The only answer I can give is, that the patio amalgamation is founded on the affinity existing between sulphide of silver and chloride of copper, and that if the torta became *hot* at the commencement, when an excess of materials were not added, then we would have no such process as the patio.

When a torta is *very* hot, amalgamation does not go on nearly so rapidly as at other times. This may be owing to the mercury becoming covered with a coating of chloride, thus preventing the chloride of silver from being reduced.

Now, according to Mr. Bowring's theory, that the first action which takes place is the conversion of part of the mercury into chloride, the torta ought to become hot at the very commencement, whereas such is not the case; and to avoid loss of mercury in this way, Mr. Bowring proposes, and has patented, the use of protochloride of copper instead of magistral.

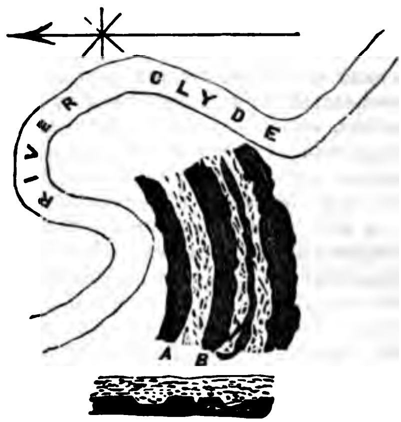
Faults, Dislocations, and Disturbances in Coal Mines.

By Mark Fryar, F.G.S.,
School of Mines, Andersonian University, Glasgow.

(*Continued from page* 345.)

The "want" is an irregularity in coal-beds of not unfrequent occurrence. A rather notable example is shown in fig. 3. The distance from A to B is about fifty-five yards, and the space is filled up with the kind of sandstone rock which forms the roof of the coal-seam. On the north side of the "want" the coal-bed is of its regular thickness, but southwards it is very much broken and mixed with sandstone over a width of more than one hundred yards. In some places the seam is more than double its usual thickness, and in others it is "nipped out" to the thinness of an inch, or the seam or bed is divided into upper or lower coal, and separated by a thin sandstone bed. This "want" is remarkable as following, with some degree of conformity the bed of the Clyde, as far as the workings of the Old Farme Pit have exposed it, a distance of about 330 yards.

Fig. 3.



In a pit some distance to the west of the Old Farme it has been met with, and is shown there to be very tortuous although deviating considerably from the course of the Clyde. The coal-seam in which it occurs is about 30 fathoms below the surface at the place shown by the drawing, but more than half of this cover consists of diluvium.* It is, perhaps, too great a stretch to suppose that the river Clyde is the stream by which the coal has been denuded from these spaces in the coal-seam, and that its bed is now 30 fathoms above its ancient level, or even that this ancient level has been sunk to that depth; the conformity of the ancient and modern river beds is however some-

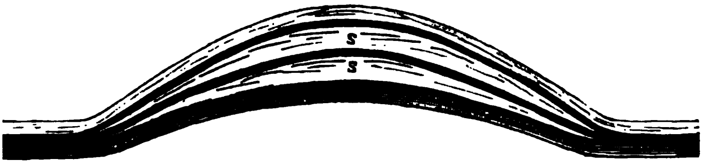
* For particulars relating to this "want," I am indebted to Mr. J. Anderson of Old Farme Colliery.

ıat striking. For the practical lessons to be derived from a study this kind of irregularity in coal deposits, it is sufficient to know ıt they are the result of denudation after the formation of the ıl-bed, and of subsequent filling up with the shale or other kind rock by which the roof of the coal has been formed.

[n the Memoirs of the Geological Survey—the South Stafford-re Coal-field, by J. B. Jukes, F.R.S.—it is shown that the Staf-dshire thick-coal, which is about thirty feet in thickness, south of ston, is in reality made up of twelve or fourteen separate coal-ms; and that these seams, although they are so close together in ces south of Bilston and towards Dudley as to give them the earance of one very thick coal-bed, are nevertheless, in more rtherly parts of the coal-field, as at Bentley, Wyrley, Pelsall, and sington, worked at from five to fifteen or twenty fathoms apart. r. Jukes very properly observes, "It may well be doubted, whether y single bed of coal is even more than two or three feet in thick-ss, and we may therefore take it for granted, that every bed which eeds that thickness, over any considerable space, is in reality a mpound seam, made up of two or more beds resting on each other, th or without 'partings' of shale, &c., between them."

Instances of this kind of separation in coal-beds are to be met th in the majority of coal-fields, and many examples might be given coal-seams being sufficiently near to each other in one part of a very nited colliery district, to be worked together as one seam; whilst other parts of the same district they are divided by several fathoms coal-measures strata. The most remarkable phenomenon of this nd which I have been made acquainted with is shown by fig. 4.

Fig. 4.



The following particulars respecting it have been supplied by Mr. ewart, of Bristol, who for many years followed the profession of ning engineer to the coal mining districts near Swansea. The dis-nce from D to E is not more than 80 yards; the "partings" S S nsist of fine blue shale, and have a maximum thickness of 10 feet ch: the three small coal seams separated from each other, are each o feet in thickness, and on each side, as at D and E, they come sely together without partings, and form a 6 feet coal bed. How r these conditions may have been maintained through a distance nsversely to this section is not known, as it was to be seen in a rpendicular cliff 200 feet high, where the coal-measures throughout e distance shown by the section were laid bare.

"Swells," or "rolls," and "nips," are names given to a rising up the floor of a coal bed, and where the roof and floor both swell t, so as to reduce the thickness of the bed. "Balk" is a name plied by the colliers of Newcastle, to the "want" illustrated by

fig. 8. "Check" is just another name for a dislocation; and "Vs" is a very convenient, and not inappropriate expression for the plane of fracture, where a displacement of the beds has taken place.

The study of faults is one fraught with interest to the geologist; but to the mining engineer, it is even more so, for, upon a due knowledge of the phenomena are depending, at this moment, the pecuniary success or ruin, or at least serious embarrassment, of many mining enterprises; and to this we may add, the reputation of the engineer, and the lives of the workmen. The Cockfield-fell-dyke, already noticed, may be cited as an example of many instances to be met with, of the effect of such faults on the water contained in the strata contiguous to mining works. On each side of this dyke, and between its vertical faces and the adjacent rocks, there occurs about six inches of strong clay, by which the dyke is rendered so completely impervious as to dam back the water of the country for miles in the direction of the fault. I know the case of a colliery, where a trial shaft having been sunk to a considerable depth, entailed a very serious outlay, and resulted in abandonment and heavy loss, owing to the large feeders of water met with. After the abandonment of this unsuccessful trial, another site for sinking was fixed upon but a short distance from the first shaft, but on the opposite side of a dyke; here a most successful "winning" was accomplished without (in sinkers' language) "a drop of water being met with." In deciding upon the place for "dams" in a pit, and estimating the efficiency of barriers of either coal or stone, the probable existence, and the number, direction, and character of faults, require careful attention. The amount and direction of the hade or dip of faults, and the probable accompanying branches or strings of a main slip or dyke, are also points of serious importance.

Illustrated Notes on Prominent Mines.

By the Editor.

EAST CARN BREA AND WHEAL UNY.

The wood-cut (figure 1) on the opposite page, shows a section of the country and workings on the run of the lodes which traverse these mines, drawn on the scale of 190 fathoms to one inch. The principal workings at East Carn Brea and Wheal Uny are shown, and also the depth of the old engine-shafts at Wheal Sparnon and East Sparnon: the latter mines not being now at work, it would be troublesome to ascertain accurately the extent to which the levels are driven, and consequently they are omitted in the section. We have already, in No. I (page 47), given a section of the workings at East Carn Brea on a larger scale: the present section is purposely drawn on a small scale in order to show the geological position of these mines, occupying a killas basin between the ranges of granite. It may also be well to remark, that the Carn Brea granite range, which in the section is shown as ending on the surface about Redruth Church, extends further east as we come south of the line of section, and consequently

FIG. 1.

SECTION ALONG THE LINE OF EAST CARN BREA, WHEAL UNY, WHEAL SPARNON, AND EAST WHEAL SPARNON.

Scale, 190 fathoms to an inch.

flanks the East Carn Brea lodes through a great port length of their sett—giving that mine a geological positior that of its great neighbours (Carn Brea, Tincroft, Cook' and Dolcoath) further west.

East Carn Brea, is worked to a depth of 50 fathoms adit, the *engine-shaft* being sunk perpendicular to the adit, that on the course of the lode: the levels are the adit, t 40, and the 50—all shown in the section extending from t shaft. The *adit*, which was driven by the "old men," and called the "silver adit," comes up from near Messrs. Magor to the south of Redruth, under the "west end" of that t ing 20 fathoms of backs at the engine-shaft. The other sh in the section are:—the *western shaft*, about 60 fathoms w engine-shaft and within 30 fathoms of the western boun perpendicular to the 40; and the *new shaft*, to be sunk per to the 26, down 17 fathoms below the surface, and raised 4 fathoms from the 26; the dotted line shows the course u this shaft will be sunk. It may be well to remark, that driven from the western shaft under the 26, called the 30 respectively within 3 fathoms of being as deep as the 40 a the engine-shaft.

Three lodes have already been opened on in East (all underlying north about 2 feet in a fathom, that is, dip with the granite. On the northernmost, called the engin engine-shaft has been sunk; to the south of this 11 fathc 50) is the middle lode, and 25 fathoms at the same level, lode. Of these, the most important is the south lode, c splendid run of ore-ground has been opened out, which n Carn Brea one of the most promising young mines in the c consequence of the engine-shaft being sunk on the engin south lode has hitherto had to be explored by cross-cut always a disadvantage; the western shaft, however, come this lode, and the new eastern-shaft will also be sunk on it 26. A little to the west of this new shaft the cross-course and just to the west of this the winze sinking below the has gone down in a splendid course of ore: the shaft, on side of the cross-course will also go down in a beautiful co

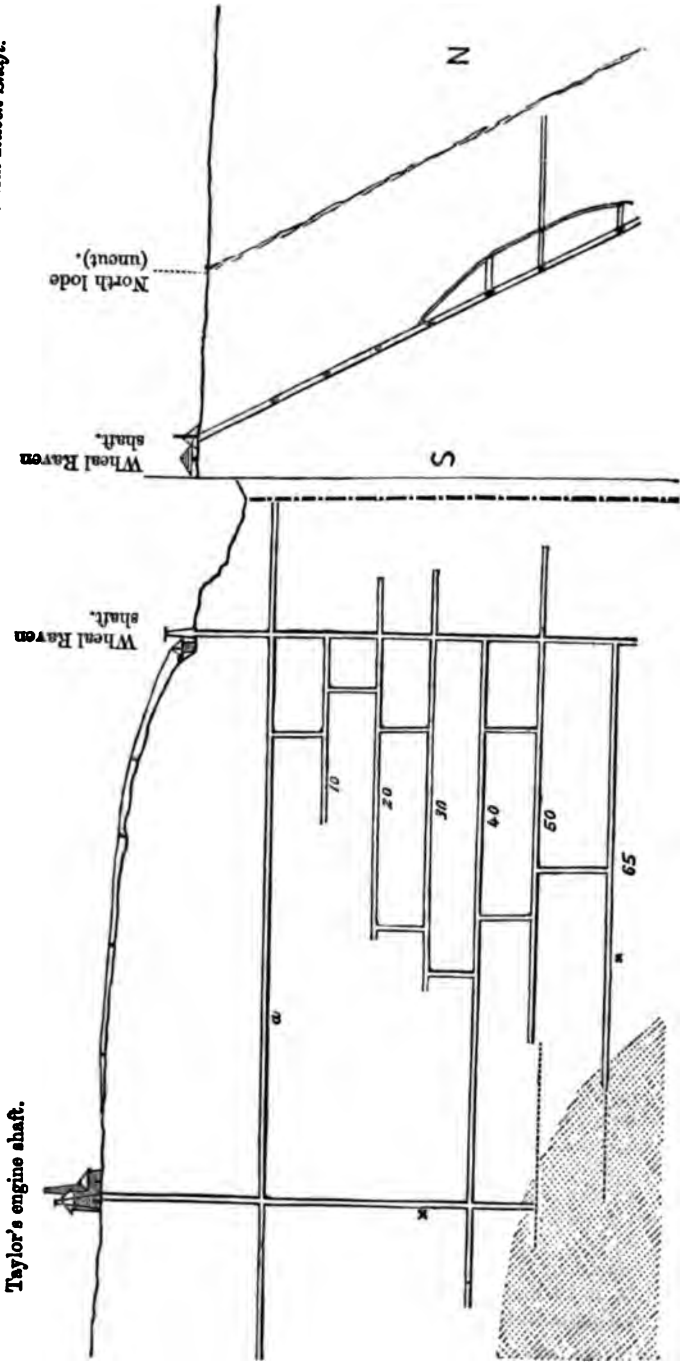
Besides the lodes already opened on, there is in this se lode to the north, supposed by some to be the lode wo Wheal Sparnon—although others maintain that the south l Sparnon lode. There has been a cross-cut driven to inters the 50, but the end—in which a stone of ore has been cut such quantities of water that it had to be stopped for tl There are also other lodes to the south, in the tongue which I have said extends east from Redruth church, fl south lodes, the chief of which are: the lode called No. Uny, and the Wheal Uny tin lode, and Davies's lode.—' course shown in the section, disturbs the lodes in rather a r manner—some of the lodes, at the same levels being he derably, while others are very little disturbed. On the w ever, the lodes are not much disturbed in their course— branch of a cross-course heaves them considerably, anothe generally found throwing them back again.

SECTIONS OF WEST TOLGUS MINE, ILLOGAN, CORNWALL.

Scale, 35 fathoms to an inch.

Longitudinal Section.

Transverse Section at Wheal Raven Shaft.



Wheal Uny is principally worked for tin, on a lode considerably south of those now wrought in East Carn Brea. It is a very remarkable lode, as it is found, for a great length of its course, dipping south with the junction of the killas and granite, very large, and producing vast quantities of low class tin stuff. We shall not dwell upon this lode at present, as we propose giving some illustrations of it in an early number. The other workings in Wheal Uny are on the East Carn Brea south lode, which has been opened out on from a shaft sunk within 35 fathoms of the boundary, called No. 3 shaft, now down perpendicular to the 58, and which will take the lode at the 70. From this, levels have been opened out at the 37 and 48, and some good ore-ground met with. This shaft, however, will not be the engine-shaft, another having been pitched for that purpose, 70 fathoms further west, which will take the lode at the 48: it is now down about 10 fathoms, and is sinking by nine men. The great cross-course, which breaks up the valley under Carn Brea Hill, and which can be traced through all the Tolgus mines to the north, traverses this sett, passing about under the church: the Carn Brea south lode also passes under the church, so that at this point they will form a junction.

WEST TOLGUS.

The wood-cut figure 2, shows two sections, on a scale of 35 fathoms to an inch, of this mine—one, a longitudinal section on the course of the lode explored, and the other, a transverse section at Wheal Raven Shaft. This mine is on the same run of lodes as the old Tolgus mine, from which it is separated by the valley shown in the section.

The old workings are prosecuted from the eastern (Wheal Raven) shaft, which had been sunk to a little below the 65 under adit. The levels from this—the adit, the 10, the 20, the 30, the 40, the 50, and the 65—are all shown in the section. Almost all these levels were driven in the former working, except the 65, which had only been driven as far west from Wheal Raven shaft, as the point marked with a cross (×). Since the mine has been re-worked, this level has been extended about 20 fathoms, and the fine bunch of ore, shown by a dotted space in the section, met with.

There had also been an old whim-shaft sunk on the lode just at the point where Taylor's engine-shaft is now put down. This had been sunk as far as the point marked with a cross (×); so that, both at this shaft and in the 65 fathom-level, the old workers were within about 20 fathoms of the ore ground. The present (Taylor's) engine-shaft is an entirely new one, sunk perpendicular to adit, and below on the course of the lode, where, in the present bottom, the ore ground has also been met with.

The present working of West Tolgus was commenced about two years ago by Messrs. John Taylor and Sons, under the management of Captain Joseph Jewell. The mine had to be forked through the old Wheal Raven shaft; but now the water from the bottom level is raised in that shaft (by a 12-inch box) to the 40, where it goes back to a 14-inch pole at Taylor's shaft. The 65 end is now about 24 fathoms from the shaft, to which it is expected to hole in six or seven

hs, when all further pumping through Wheal Raven-shaft will pensed with.

sides the main (or south) lode, another lode is known to exist to orth, to which a cross-cut is being extended at the 50. This and cross-cut is shown in the Transverse section. Another called the *north branch*, has also been cut in the 40, 50, and 65 n-levels. Going upwards, it falls, as shown in the section, into uth lode, and in depth it also seems to be bending back towards it.

e give a drawing in Plate IV., of an arrangement adopted at aine by Captain Jewell, for breaking the underlie of the pump- the shaft. It is found to work admirably here and at South s, and is a great saving of cost, as it dispenses with the necessity ting ground for a bob-plat.

Abstracts and Reviews.

MINERAL INDUSTRY OF THE AUSTRIAN EMPIRE.

the *Revue Universelle*, abstracted from Friese's Memoir in the *Zeitschrift des œst. Ingenieur-Vereines*.)

w of January, 1854, which put a limit to the exaggerated demands of proprietors, coupled with the rapid extension of railways, and the of industrial energy, and of association which is everywhere evident, given such an impulsion to the mineral industry of Austria as to cause plete transformation within a few years. This continually increasing rity of the mineral industry of the empire shows that there was only ed, for its development, a due regulation of its rights and burdens.

ENT OF CONCESSIONS.—According to official returns*, the mineral sions at the end of 1859 comprised 301,244,313 square *klafters*, or 266,000 acres. This does not include salt-works, which are worked at concessions. The accompanying table shows the manner in which are distributed throughout the different mining districts of the e, and the proportion of the empire of each wrought for the various al products.

regarding the various provinces of the empire, we see that the working n as well as of coal preponderates in the countries in the region of the The group of miscellaneous minerals, which principally comprise of lead and mercury, also occupies a considerable surface in this t; but, on the other hand, the working of gold and silver is here ificant.

Bohemia the coal-workings occupy more than three-fourths of the sur-e conceded; and they exceed in extent that of the collieries of all the f the empire. The iron-ores are almost as considerable as in the pre- g district. The noble metals are also worked to a considerable extent, the mines of miscellaneous minerals are scarcely represented: the and silver mines of Bohemia occupy about a fifth part of the total e wrought for these metals in the Austrian States.

e working of coal also preponderates in Moravia, Silesia, and Western ia: it is the same with iron, but in a less degree. As to Eastern ia and Bukowine, the workings there are very restricted.

he title of the official returns of the Austrian Government is *Uebersicht der ltnisse und Ergebnisse des Oesterreichischen Bergbaues im Verwaltungs* 1859. A very full abstract of these is given in Vol. xix. of the *Annales ines*.

TABLE SHOWING THE EXTENT OF SURFACE CONCEDED IN THE DIFFERENT PROVINCES, 1859.

Provinces.	Mining Districts.	Underground Workings. Gold and Silver.	Iron Ore.	Carbonaceous Minerals.	Other Minerals.	Open Workings.	Total Surface.
		Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
Austria (Upper)....	St. Pölten ..	..	2,020	8,724	359	..	11,104
„ (Lower)	„	..	56	9,489	22	..	9,569
Styria	Leoben	46	2,198	2,090	636	..	4,971
„	Cilly	156	914	10,349	190	..	11,608
Carinthia..........	Klagenfurt..	45	2,355	1,617	6,970	120	11,105
Carniola	Laybach ...	..	4,312	2,173	569	3,401	10,477
Coasts of Adriatic ..	„	22	..	203	110	..	380
Tyrol	Hall	67	926	1,574	1,373	747	5,054
Salzburg	„	435	494	..	335	85	988
	Total	771	13,274	36,220	10,563	4,353	54,778
Bohemia	Pilsen	67	3,781	16,185	2,084	67	22,185
„	Elbogen....	2,833	1,424	12,834	1,039	146	18,276
„	Kommotau	473	348	27,430	357	172	28,781
„	Küttenberg	279	2,358	9,606	2,561	23	14,827
„	Prague	1,242	4,906	13,426	459	..	20,034
	Total	4,894	12,817	79,481	6,501	409	104,102
Moravia	Olmutz	11	7,756	6,085	560	3	14,416
Silesia	„	167	2,471	4,738	45	..	7,422
Gallicia (Cracow) ..	Cracow	..	6,695	25,979	4,661	80	37,415
„ (Lemberg)..	Lemberg ..	..	480	900	..	278	1,658
Bukowine	„	22	78	..	67	81	248
	Total	201	17,480	37,703	5,333	442	61,159
Hungary (Ofen)....	Ofen	370	222	..	132	..	723
„ (Oldenburg) ..	„	..	585	89	45	..	719
„ (Presburg) ...	Neusohl....	13,665	1,222	89	1,299	50	16,327
„ (Kaschaw)....	Kaschau ...	334	2,559	..	1,751	253	4,898
„ (Grosswardein)	Nagybania..	2,404	285	..	138	..	2,827
	Total	16,773	4,873	178	3,366	303	25,494
Voïvodia	Oravicza ...	20	1,542	..	1,213	3	2,777
Transylvania (Siebenbürgen)	Zalathna ..	2,099	404	547	130	349	3,575
Croatia and Slavonia	Agram	..	201	758	67	1,434	2,460
Mil. Frontier Croatia	„	..	312	..	881	345	1,538
„ „ Banat	Oravicza ..	..	371	..	202	156	730
	Total	2,119	2,830	1,305	2,494	2,332	11,080
Venetia	Bellune	..	..	179	190	..	369
Dalmatia..........	Zara	..	..	89	390	..	479
	Total	..	..	268	580	..	848
General Total	..	24,748	51,275	153,378	28,837	7,840	266,088

The greatest extent of gold and silver mines is found in Hungary and the Siebenbürgen—that is, about four-fifths of the total extent of these mines in the entire empire. In Hungary it is especially in the mineral districts of Kaschau and of Neusohl, that we find iron-mines and mines of miscellaneous minerals (principally copper); the working of coal, on the contrary, as in the Siebenbürgen and Voïvodia, has but a limited extension; probably, because before 1859 the right of extension belonged to the proprietor of the soil.

It will be seen that but a very restricted extent of surface is wrought in Venetia, and likewise in Dalmatia.

Arranging the different states of the empire according to the extent of surface conceded, we have them in the following order, the figures indicating the number of acres conceded :—

Bohemia	104,102	Transylvania (Siebenbürgen)	3,575
Western Gallicia	37,415	Voïvodia	2,777
Hungary	25,494	Croatia and Slavonia	2,460
Styria	16,579	Military Frontier	2,268
Moravia	14,416	Eastern Gallicia	1,658
Carinthia	11,105	Salzburg	988
Upper Austria	11,104	Dalmatia	479
Carniola	10,477	Venetia	369
Lower Austria	9,569	Coasts of Adriatic	380
Silesia	7,422	Bukowine	248
Tyrol	5,054		

Of the entire surface conceded, 7,840 acres are worked open-cast (*Tagmassen*), which only extends to the depth of the solid rock; and the remainder, about 258,240 acres, is wrought by underground works (*Grubenmassen*), which may extend to any depth. The State works by itself, or with partners, about 18% of the entire surface conceded, the remaining 82% being abandoned to private enterprise. About half the surface worked—whether by the State or private enterprise—is wrought for coal; of the other moiety of the surface worked by the State, the greater proportion is wrought for the precious metals.

After concessions—that is, existing properties,—we turn to those which may be future properties, for which exploring licenses have been granted in great numbers. These evidence, even more than the concessions themselves, the energy with which Austria, far from remaining stationary, is preparing new fields of industry.

In order to be declared the discoverer or *concessionnaire* of a mine, it is requisite, in the first place, to have received a license by virtue of which all the necessary explorations can be made within a radius of 224 *klafters* (about 45 acres). At the end of 1859, the number of these licences was 15,616, extending over a surface of 2,188,320 acres. Of all the provinces of the Crown, Bohemia is the most sought after in this respect, 4,419 licences having been issued. Hungary comes next with 3,187. Moravia and Silesia number 2,293; Western Gallicia 1,822; the region of the Alps 1,688, and the Banat 820.

These figures show the ratio between the extent of surface, conceded, and that under licence at about 1 : 8·2—that is, there is eight times more surface under exploration than under absolute working, a state of things showing a marvellous amount of speculative enterprise. Compared with the total surface of the empire, which we may take at 1,000,000,—the proportion conceded and under licence for exploration is as follows :—

1,675 conceded.
13,687 under licence for exploration.

15,362, or about 5·17% of the empire.

If we consider the various provinces separately, we find they vary widely. Venetia presents a *minimum* of surface conceded; while Bohemia—especially the districts of Brüx (Kommotau), Elbogen, Prague, and Pilsen—show a *maximum*. These last-named districts, with Silesia, Eastern Gallicia, and Moravia, have received the greater number of licences; the district of Elbogen presenting the *maximum*, licences having been given for explorations over 1·2°/₀ of its surface. It is worthy of remark that the number of these exploring licences are in the greatest proportion in the eastern parts of the empire, where the spirit of speculative enterprise seems to be most in the ascendant.

Compared with France and Belgium, we have the following:—As to the *extent* of surface conceded, while Austria only shows 0·17°/₀, France has 0·9°/₀ of its surface under concession, and Belgium 5·7°/₀. With regard to the *number* of concessions, in Belgium they reach 293, in France 462, while in Austria they amount to about 1,300. So that the relative area of each concession in these countries would be,—

Austria 100; Belgium 960; France 230.

This shows, at a glance, the great fault of the Austrian system, which is the indefinite multiplication of insignificant enterprises, such as can rarely be expected to produce important or durable results. This is pushed to such an extent in some provinces, as in Transylvania, for example, that many works are wrought exclusively by the members of the family of the proprietor.

Comparing the concessions existing in 1859 with those of the three previous years, we find that they have increased, in the case of iron ores, $16\frac{1}{2}$°/₀; in the case of coal, $13\frac{1}{3}$°/₀; and in the case of various minerals, $11\frac{1}{3}$°/₀. During the same period, the extent of surface worked for the noble metals, decreased by $8\frac{3}{4}$°/₀, which may be attributed, in a great degree, to the abandonment of certain mines nearly exhausted, or holding out little prospects of success, on the introduction of the mining taxes of 1855. But, as this cause has similarly affected coal and iron, the result seems rather to be due to the prevailing spirit of Austrian enterprise, which appears principally to direct itself towards the development of those mineral resources which form the bases of industry, and which seems to have recognised that there, as elsewhere, a coal-mine is better than a gold-mine.

Production of the Austrian Mines.—No other nation produces such a variety of mineral products as Austria. By the side of gold and silver, we have the various species of carboniferous minerals, and a considerable production of copper, lead, mercury, zinc, nickel, cobalt, antimony, sulphur, alum, and various other minerals—many rare. The following table shows the quantity and value of this production for the year 1859:—

Mineral Produce of Austria for 1859.

Products.	Quantity.	Value.
	lbs.	£
Gold	4,412	222,292
Silver	92,532	308,594
Total Value....	....	£530,886
	Tons.	
Iron (d'affinage) .	282,740	1,716,542
„ (demoulage)	39,890	431,521
Total Value....	.... £	2,148,063
Coal.............	1,732,000	550,471
Lignite	1,349,200	321,836
Anthracite	840	260
Total Value....	....	£872,567
Copper..........	2,585	266,603
Lead	6,260	159,020
Litharge	1,300	32,119
Lead Ore (exptd.)	1,940	16,465
Mercury	360	73,131
Nickel and Cobalt	386	20,482
Zinc.............	1,265	24,157
Zinc Ore	5,390	4,693
Crude Antimony and Regulus .	398	12,647
Antimony Ore ..	92	415
Arsenic	43	570
Sulphur	1,540	15,167
Pyrites..........	7,340	8,996
Sulphate of Iron .	3,220	10,607

Products.	Quantity.	Value.
	Tons.	£
Sulphate of Copper	138	4,988
Alum	1,380	14,014
Aluminous Schirts	36,780	989
Graphite........	4,970	6,134
Oxide of Manganese	65	81
Chromium Ore ..	40	189
Tin	51	6,630
	Cwt.	
Bismuth	2	63
	Tons.	
Wolfram	28	281
Uranium Ore	3½	1,650
Orpiment	1½	9
Silver Ore	31	148
Copper Ore......	3,720	7,410
Iron Ore...... .	27,225	17,377
Asphalte Rock ..	330	150
Asphalte	67	382
Total Value....	....	£699,582

Summary.

Noble Metals	12·2 °/o	530,886
Iron............	52·1 °/o	2,148,063
Carbonaceous Minerals....	19·6 °/o	872,567
Other Minerals ..	16·1 °/o	699,582
	100·0	£4,251,098

Comparing the production of the empire during this year with that of 1855, we have the following results:—

Increase—Coal 53°/o; Lignite 44°/o; Gold 11°/o; Iron 15°/o; Mercury 61°/o; Zinc 33°/o; Litharge 215°/o; Alum 4°/o; Nickel and Cobalt ores 57°/o; Zinc ores 36°/o; Pyrites 96°/o; and Graphite 36°/o.

Decrease—Silver 1°/o; Lead 21°/o; Nickel-spies 50°/o; Arsenious Acid 42°/o; Sulphur 5°/o; Sulphate of Iron 31°/o; Sulphate of Copper 36°/o; and Asphate 58°/o.

The total number of persons employed in mines throughout the empire, in 1859, was 105,432, comprising 93,270 men, and 12,162 women and children. Of these, nearly 40,000 are employed in Bohemia, Moravia, and Silesia—12,592 being employed in the district of Prague. About 36,000 are employed in Hungary and Transylvania; 7,800 in Styria; 6,000 in Carinthia; 3,500 in Gallicia; 2,900 in Servia and the Banat; 2,300 in Austria (upper and lower); 1,900 in Tyrol; and about 1,000 each in Venetia, Bukowine, and Salzburg.

The number of accidents among this population during the year was 1,187. Of these 838 were slight, 183 serious, and 166 fatal.

ON THE DOUBLE SULPHIDES OF COPPER AND IRON.

By Frederick Field, F.R.S.E.

(From the *Journal of the Chemical Society*.)

About two years ago, I made a verbal communication to the Chemical Society, upon certain double sulphides of copper and iron, produced by the fusion of the native compounds of those metals containing sulphur and oxygen. The experiments which were then enumerated, and which had extended at intervals over several years, have lately been resumed, and now, in a more complete form than heretofore, may perhaps be not deemed wholly uninteresting.

In countries where coal and labour are expensive, and building materials for furnaces, such as fire-bricks, fire-clay, &c., have to be economized as much as possible, it becomes necessary to devise some means in the smelting of copper ores, whereby fuel may be saved, and damage of the furnace alleviated. The process of roasting poor regulus, into a sulphide richer in copper, is that usually resorted to in England, but this roasting acts at the same time, very severely upon the sides of the furnace, as the slag, consisting to a great extent of oxide of iron, combines with the silica of the clay and of the bricks, forming silicate of iron. To avoid this difficulty, advantage is taken of the fact, that oxide and sulphide of copper mutually react upon each other, forming sulphurous acid and metallic copper—

$$2\,CuO + Cu_2S = 4\,Cu + SO_2$$

so that when an excess of the latter is employed, combined at the same time with more or less sulphide of iron, a rich regulus is produced, and the process of roasting is obviated. For example, if into a mass of fused regulus of low percentage, a few hundred weight of the carbonates of copper are introduced, and the whole brought to a state of fusion, the oxide of iron formed combines with the silica of the ore, producing a fusible slag, and a great portion of the sulphur is oxidized at the expense of the oxygen contained in the carbonates. By adopting this method, regulus of a very high percentage may be obtained, and even metallic copper, if sufficient oxygen be present in the mineral to convert the whole of the sulphur into sulphurous acid. Practically speaking, however, this latter plan is seldom or never adopted, the smelter preferring to tap the regulus when it contains from 40 to 50 per cent. of copper, as, if richer, the slags invariably contain much of that metal.

Many analyses have been made of the double sulphides of copper and iron, technically known as regulus, but probably owing to the ores themselves containing many other metals, such as tin, arsenic, antimony, and occasionally silver, it can scarcely be wondered at that the results of the investigations of various chemists upon this particular subject are not very concordant. From my own experience I am led to believe, that copper regulus always has a certain definite composition, and analyses of many specimens, collected from different quarters of the world, fully confirm the idea.

It appears that the copper invariably exists in the state of disulphide (Cu_2S) in regulus, associated with iron in various states of sulphuration. The sulphides of iron seem to exist in certain relative proportions, and the richness or poverty of the regulus in copper, to depend upon the number of the equivalents of disulphide in combination with them. It cannot be denied that certain facts seem to militate against this view, as for example, the action of hydrochloric acid upon the compound. Regulus of from 25 to 50% copper, generally evolves sulphuretted hydrogen copiously, when treated with this acid, whilst that containing from 60 to 80% is scarcely acted upon at all; but, nevertheless, the proportions of copper, sulphur, and iron, are so invariable, as to lead us to suppose that it is the great

of disulphide of copper, which shields or protects the sulphides of rom the acid, rather than that those sulphides have changed their che- condition. And this case is not without a parallel. Silver, so readily ed by nitric acid, is not affected by that re-agent when alloyed with cess of gold; neither, by means of hypodrochloric acid, can zinc be ted from copper, when the latter is in great excess; and, in like er, when the number of atoms of disulphide of copper, combined with on-compound are diminished, much of the iron is dissolved, which, other circumstances, would remain unaffected. It is, therefore, it that no results can be deduced as to the state in which the iron , by measuring the quantity of sulphuretted hydrogen evolved by the of hydrochloric or sulphuric acid.

hen regulus is repeatedly roasted, and the slag which accumulates the surface is skimmed off, a point is arrived at, when all the iron is rawn, and a pure disulphide of copper remains, having exactly the specific gravity, physical appearance, and chemical composition, as the disulphide, copper glance. The sulphides of iron are all decomposed the sulphide of copper is attacked, and it would almost appear that ompound plays the part of a base, as regards the sulphides of iron, hat the more concentrated the regulus becomes, the more basic is its sition. If a small quantity of oxide or carbonate of copper be ed into a fused mass of the sulphide of iron, a disulphide of copper is ced, exercising a certain influence upon the whole compound with l to the solvent action of acids.

gulus appears to me to consist of one atom of sesquisulphide of iron one atom of protosulphide FeS, and two atoms of disulphide Fe_2S, ated with disulphide of copper. Thus, a portion of clean regulus from ace yielded on analysis—

Copper	36·12
Iron	36·78
Sulphur	27·08
	99·98

Cu_2S) Fe_2S_3, FeS, 2 Fe_2S. On roasting this compound for some hours, gulus yielded—

Copper	49·71
Iron	25·34
Sulphur	24·85
	99·90

(6 Cu_2S) Fe_2S_3, FeS, 2 Fe_2S.

gain, after further roasting and skimming, another sample was sub- l to analysis, and the results were as follows:—

Copper	61·34
Iron	15·61
Sulphur	22·90
	99·85

(12 Cu_2S) Fe_2S_3, FeS, 2 Fe_2S_3.

though the native yellow copper pyrites have a different composition, due sulphides seem to follow the same law, as the artificially prepared us. Thus a very pure specimen yielded me—

Copper	54·21
Iron	21·43
Sulphur	24·12
	99·76

or $(8\,Cu_2S)\,Fe_2S_3,\ FeS,\ 2\,Fe_2S,$

which requires—

Copper	54·93
Iron	21·04
Sulphur	24·03
	100·00

It is interesting to observe the rapid decrease in the proportion of iron, in comparison with the sulphur, as the copper augments. When the regulus contains 36°/₀ of the latter metal, it contains also 36°/₀ iron, and about 27°/₀ sulphur. At 50°/₀ of copper, the sulphur and iron are in nearly equal proportions. At 60°/₀ the iron is reduced to 16·5°/₀; and the sulphur to 23°/₀, while at 80°/₀ copper, all the iron has disappeared, and 20 per cent. of sulphur remains.

MR. JUKES' MANUAL OF GEOLOGY.

The Student's Manual of Geology. By J. Beete Jukes, M.A., F.R.S., Local Director of the Geological Survey of Ireland, and Lecturer on Geology to the Museum of Irish Industry. Edinburgh: Adam and Charles Black.

In our last number we referred to Mr. Jukes' labours in the cause of physical and chemical geology, and it is, consequently, an agreeable task to turn to the second and greatly enlarged edition of the work we had then in view.

To our mind, Mr. Jukes' Manual occupies a position distinct from any other complete geological text-book. There are numerous other capital books on the science—profound treatises by great philosophers, and clever compilations by practised book-makers,—but Mr. Jukes gives us the first complete work which can be said to be thoroughly *practical*, such as we should expect from one of the most experienced field-geologists of the day. Indeed, on some portions of geology—such as that division which he classes under the head of Petrology—his book almost stands alone, for we certainly know of none other where these important matters are any thing like so fully treated on.

Next month we shall take the opportunity of referring to some important questions of practical geology, which are raised by Mr. Jukes. At present, we need only say that for mine agents, or any one else desirous of really studying geology practically, we earnestly recommend Mr. Jukes' *Manual*. Mine agents generally, we are sorry to say, have no conception of geology, whatever some of them may think to the contrary. Where they are conscious of their ignorance, which is the case with the abler and more sensible men—who freely admit, like Lord Derby, that they belong to a pre-scientific age—no mischief ensues; but where they fancy they know a great deal, really knowing absolutely nothing, a vast amount of harm is done. We do not value scientific education, as an aid to practical mining and metallurgy, as much as some do; but a close contact with a mining population daily shows us the necessity of an education of the kind, not so much for its practical value, but to save the men from being deluded by the ridiculous speculations of a set of *charlatans*. A work like Mr. Jukes'—sound, clear, and forcibly written,—with matter derived, to a great extent, from field labours, and, consequently, eminently practical, is just the one for the mine agent.

THE MINERAL AGENT'S HANDBOOK.

Mineral Agent's Handbook. By G. C. MAHON, Esq. Edited by the Rev. SAMUEL HAUGHTON, M.A., F.R.S., President of the Geological Society of Dublin; and ROBERT H. SCOTT, M.A., Secretary of the Geological Society of Dublin. London: Williams and Norgate.

THIS book, which is the production of a gentleman who describes himself as a retired conveyancing attorney, is not intended for *mine-agents*, but for a class which the author calls "mineral agents,"—that is, agents to landed proprietors, holding a similar position with respect to mineral properties that land agents hold with respect to agricultural property,—and it is exclusively confined to the consideration of metalliferous mining. In the English metalliferous mining districts there is no such class as Mr. Mahon contemplates, the mineral property being managed by the ordinary steward associated with a practical mine agent; and we doubt if, in any country, there is scope for such a profession as that of an agent devoting himself exclusively to the mineral exploration of estates in the interest of the landlords.

In fact, this Handbook may be considered as an *amateur* guide to *amateur* mining. It is not a work for practical men; but for land-owners and land-agents it will be found extremely useful, for it contains a vast amount of valuable information, ranging as it does from mineralogy to dialling, and from mine-exploring to conveyancing. We think, however, even on the latter subject, some of Mr. Mahon's views would be modified by a couple of years' practice in Cornwall.

THE *ANNALES DES MINES* ON THE PRESENT POSITION OF THE METALLURGY OF IRON IN ENGLAND.

Annales des Mines, ou Recueil de Mémoires sur l'Exploitation des Mines, et sur les Sciences et les Arts qui s'y rapportent. Rédigées par les Ingéneurs des Mines, et publiées sous l'Autorisation du Ministre des Travaux Publics. Cinquième Serie. Tome XX. 1861. Paris: Dunod, Quai des Augustins.

WE regret, in consequence of the pressing engagements of the gentleman who was making the abstract of these papers for us, that we have not yet been able to complete them. This, however, is of the less consequence, as the papers themselves are not yet completed in the *Annales des Mines*. We shall continue our abstract next month.

MANCHESTER GEOLOGICAL SOCIETY.

February 25th, 1862.—Joseph Dickinson, Esq., F.G.S., President, in the Chair. After the conversation on the Miners' Permanent Relief Fund, the following paper was read: "On Mr. Aytoun's Patent Safety-Cage for Mines." By Mr. J. J. Landale, Mining Engineer, Edinburgh. Read by Mr. Binney.

The description given in this paper, was illustrated by large coloured drawings; and, as it would not be understood without graphic illustrations, it will be necessary to rest satisfied by saying that the principle of Mr. Aytoun's Safety-Cage appears to differ from that employed in those in ordinary use, in this, viz.—that it provides for the safety-apparatus being quickly brought into action, by the intervention of two strong springs, before the cage shall have acquired a dangerous velocity; whereas those in previous use, have no provision for hastening the action of the safety-apparatus, except the weight of the cage and its contents. The author of the paper

seemed to consider that all the safety-cages previously brought before th
public had been complete failures; but he thinks the fate of the one h
described different, as the principle upon which it is constructed, will rende
the miner in his descent to, and his ascent from, his daily labour, near
complete safety than he has hitherto been.

The President—It is perhaps going too far to say that all these safet
cages, which have already been tried, have proved failures. We have Owen
Safety-Apparatus in this county, which is working well, and it appears
me to be giving great satisfaction. I think the remarks of Mr. Landale,
this respect, must be taken as applying to those they have had in Scotla
not to those in this part of the country.

The first part of the paper by Mr. J. J. Atkinson, Her Majesty's Insp
tor of Mines for the South Durham District, "On the Gases met with
Coal Mines, and the general Principles of Ventilation," was also read. Thi
paper, which was continued and concluded at the meeting of March 25, is
one of the most able and exhaustive elementary treatises ever yet given on
the subject of ventilation, treated in a small compass. It does infinite
credit to the author, and equal honour to the Society at which it was read.
It would be impossible to give any adequate notion of it in a short abstract;
and it is the less necessary to attempt to do so, as it is stated that it will
appear in a separate form. It can be had at the present moment, by procuring Nos. 11, and 12 of the Transactions of the Manchester Geological Society, which are published, at Sixpence each, by Messrs. Thomson and Baxter, 40, Princes Street, Manchester.

GEOLOGICAL SOCIETY OF LONDON.

March 19*th*, 1862.—Professor A. C. Ramsay, president, in the chair. Elliot Square, Esq., London; Ernest Shelley, Esq., Avington House, Winchester; Edward Romilly, Esq., 14, Stratton-street, Piccadilly; the Right Honourable Edward Cardwell, Esq., M.P., 74, Eaton-square; George W. Stevenson, Esq., F.S.A., C.E., Halifax; George W. Hemans, Esq., C.E., 32, Leinster Gardens, Bayswater; and Harvey B. Holl, M.D., Malvern, were elected fellows.

The following communications were read:—

1. "On the Sandstones, and their associated Deposits, in the Valley of the Eden, the Cumberland Plain, and the South-east of Dumfriesshire." By Professor R. Harkness, F.R.S., F.G.S.

2. "On the Date of the Last Elevation of the Central Valley of Scotland." By Archibald Geikie, F.R.S.E., F.G.S. After alluding to the position and nature of the raised beach, which, at the height of from twenty to thirty feet above the present high-water mark, fringes the coast-line of Scotland, the author proceeded to describe the works of art which had been found in it. From their occurrence in beds of elevated silt and sand, containing layers of marine shells, it was evident that the change of level had been effected since the commencement of the human period. The character of the remains likewise proved that the elevation could not be assigned to so ancient a time as the Stone Period of the archæologist. The canoes which had from time to time been exhumed from the upraised deposits of the Clyde at Glasgow, clearly showed that at the time when at least the more finished of them were in use, the natives of this part of Scotland were acquainted with the use of bronze, if not of iron. The remains found in the corresponding beds of the Forth estuary likewise indicated that there had been an upheaval long after the earlier races had settled in the country, and that the movement was subsequent to the employment of iron. From the Firth of Tay similar evidence was adduced to indicate an upheaval possibly as recent as the Roman occupation. The author then cited several antiquaries who, from a consideration of the present position of the Roman remains in

cotland, had inferred a considerable change in the aspect of the coast-line ince the earlier centuries of the Christian era. He pointed out also several ircumstances in relation to these Roman relics, which tended to show a hange of level, and he referred to the discovery of Roman pottery in a point f the raised beach at Leith. The conclusion to which the evidence led im was, that since the first century of our era the central parts of Scotland, om the Clyde to the Forth and the Tay, had risen to a height of from wenty to twenty-five feet above their present level.

MINERS' PERMANENT RELIEF FUND.

A MEETING of delegates representing the miners of Northumberland and Durham was held in St. James's Chapel School-room, Newcastle, on March 29, o hear the report of the deputation appointed to wait upon the Committee of the Coal Trade, in order to ascertain their sentiments respecting he establishment of a permanent relief fund, and to transact other important business relating to the proposed fund.

The Chairman (Mr. John Howie) read the report of the interview of the leputation with the Committee of the Coal Trade on the 18th March. It tated—Upon being admitted the resolutions of our committee were read, after which we were requested to state their views. We referred to our resolutions, by which we had agreed to subscribe one penny per week per man, and boys under eighteen one halfpenny, for the relief of distress caused by fatal accidents and permanent disablement. We hoped the masters would pay an equal amount. The management of the fund, we considered, should be equally divided between masters and men, and were wishful that a third party should have a voice in the management, such as the National Association, or honorary members who might be wishful to assist the miners in carrying out a permanent fund by becoming subscribers. The masters, however, did not see any necessity for a third party, considering that the masters and men were competent to manage their own business. We said we thought the men believed that a third party of disinterested subscribers would assist very materially in carrying on the business to the satisfaction of all concerned. We were asked if we had made any calculations as to how far our subscription of one penny would meet accidents? We said we believed the amount mentioned, if equalled by the masters, would go far to meet fatal accidents and permanent disablement, but we believed that if it should prove to be insufficient the men would willingly pay a little more. Some discussion then took place on the propriety of it being a national fund, or whether it should be confined to these two counties. The masters appeared to be much opposed to going beyond these two counties. They thought that the management would be much more simple if the business of each large district, such as these two counties, was confined to itself. If it were proposed to admit any single parties belonging to other districts to a participation in the benefits, the result would be great confusion, and perhaps discord in the distribution of the funds. In fact, they considered that the proper management of the fund, if national, almost, if not altogether, impracticable, and any attempt to carry it out to such an extent might interfere very much with its usefulness.

After a lengthened discussion of details, before leaving, we wished to state that we considered that the masters were entitled to pay as much as the men, not as a matter of charity, but in justice. We thought it would be admitted, that a great number of accidents happened through the want of proper care and attention on the part of the employers, or those having charge under them, and in justice the masters ought to relieve distress caused by such neglect. On the other hand, we were willing to admit, that many accidents happened for which the men were blameable them-

selves, and on the same principle of justice we had a right to meet them; but, after all, a great number of accidents happened which could not be foreseen, and for which nobody was blameable. Who is to pay for them? Let the masters and men meet such cases between them, and then all would be provided for. The masters did not wish to discuss the subject at present. They wished another delegate meeting to be called, as they expressed doubts as to whether a majority of the men wished the fund to be national or not, and they likewise wished to know the result of a full meeting on the permanent disablement clause. We therefore agreed to call this meeting.

It was then resolved:—"That each man subscribe one penny a week, and each boy under eighteen a halfpenny, to the permanent fund for the relief of the distress arising from fatal accidents and permanent disablement, and that an equal amount should be solicited from the masters, such subscriptions to be applied to the relief of the distress caused by any fatal accidents as might happen to any paying member during the time which may elapse before such fund is permanently established."

Within the last few days, the *Newcastle Daily Chronicle* states that the Secretary to the above fund has received a letter from the Secretary of the Coal Trade, to the effect that the committee of that trade has held a special meeting upon the proposed fund; that they have considered it in all its bearings; and that they are now ready to give their decision to the deputation which was appointed at the last delegate meeting. The day fixed is Tuesday, the 29th April, for the interview. Then the committee will probably call a general delegate meeting, to be held on Saturday, May 10th, at Newcastle. The committee hope that each colliery will send delegates to such meeting, to hear the decision of the coal trade, to adopt some practical resolution towards the establishment of a Miners' Permanent Relief Fund.

The following discussion, which took place on this subject at the meeting of the Geological Society of Manchester on February 25th, will probably be read with interest:—

Mr. E. W. Binney asked the opinion of the meeting upon the propriety of forming a local fund for the relief of widows and orphans and other persons dependent upon men killed, or disabled in following their occupations as coal miners. He said, if a district association were formed in Lancashire and Cheshire instead of a central association in London, as was proposed, it would probably commend itself more to the coal owners and the public here than the one in London, and the funds would probably be better dealt with, and the colliers would have more faith in it. Probably the best way to proceed would be to call a public meeting of the coal proprietors, and Manchester was a place where such a thing might be started.

The President said, he understood that there was already a surplus from the Hartley Colliery Fund, which was to be applied as the nucleus of a fund for the Northumberland and Durham miners, who had expressed their preference for a local fund rather than a national one. There was ample scope for a local fund for Lancashire and Cheshire, and the Manchester Geological Society was a very proper medium by which to bring it before the public, because it stood on neutral ground.

Mr. Andrew Knowles thought that if the fund were confined to Lancashire and Cheshire the money would be more equitably distributed than by a London association. Mr. Binney had not explained the manner in which the fund, when collected, should be distributed.

The President said the fund would, no doubt, be for the widows and others dependent on those who might loose their lives.

Mr. Binney said, the manner of distribution would be a proper subject for discussion at a meeting to be called to consider how the subscriptions could be raised. No doubt, the coal proprietors and the colliers themselves would contribute, and it was a question whether a sick-club might not be connected with the fund; but all those are things to be decided hereafter.

'resident—Sick clubs seem to be already well managed by the ho have started them.

hn Fletcher—Are you not magnifying the necessity for a call of l upon the public? I think I am right in saying that whenever mt has happened there have been sufficient funds provided in the rhood. The recent Hartley case, of course, has become a national at I do not think we should infer from it that it has become neces- ; the whole nation should be called upon to meet accidents of this think there is a disposition on the part of colliery owners to assist ; and as long as the accidents are diffused over the country, they n the ordinary way.

resident—It is generally found that in small accidents, where only ro persons are killed, the relations are not provided for so well as extensive cases.

etcher—Of course, they are not provided for so well as the relatives se of the Hartley Colliery. It has been suggested as desirable to und, to be provided by the workmen and masters. I am not at say all I know on the subject, but it is a matter that is being ted, and may probably be the subject of legislative enactment.

resident suggested the propriety of adopting some resolution upon ct.

ney agreed that the most natural way of forming a fund, seemed to ekly contributions generally, both by men and masters, over the strict.

etcher suggested that the subject might be adjourned till after the . discussion by the mining association in London.

nney—The only question is whether a fund of this sort would not managed on the spot—whether the men would not have greater l confidence in it. If the money which they contributed was sent m, and London men were to come down and investigate every case, seem a round-about sort of way of doing it.

letcher—The distribution of the money is an important question ; thing, however, is how to raise it.

inney—It has been proposed to charge ½d. or 1d. per ton upon the

'resident—The question is a very proper one for discussion ; but a neeting should be called to discuss it.

.tkinson (honorary secretary)—A charge of ½d. per ton upon the llions of tons raised annually, would amount to 125,000l. a-year, t would be a very large fund. Would it not be desirable to call a neeting of miners and geologists on the subject? I will propose, , meeting be held at some convenient and not distant day, for the n and investigation of this subject."

letcher—Seeing that this matter is to be brought forward in Lon- re our next meeting, I think it would be better to leave it over n.

resident—Then I will take that as the pleasure of the meeting.

Correspondence.

[We need scarcely say that we cannot hold ourselves responsible for the facts or opinions of our correspondents; although we shall make it a point to endeavour to exclude those who are obviously inaccurate or fallacious, as far as is consistent with our wish to encourage the freest discussion.]

PRACTICAL MINING.

Sir,—Considering that one of the great items of expenditure in working our metallic mines is the cost of sinking shafts and driving levels, it is a question of some importance to us miners to consider,—Whether, or not, we are conducting this part of our operations in the most economical way possible? As the subject is an eminently practical one, a few remarks thereon may, probably, not be out of place in your magazine.

Our forefathers, the early miners of this country, conducted their explorations on a much smaller scale, or system, than we do now; their levels being generally carried only from 5 to 6 feet high and from 2 to 3 feet wide, and their shafts small in proportion; but in all well-conducted mines now at work, the shafts and levels are very much enlarged upon the above-named dimensions, greatly to the benefit of the mines, both in point of economy in the cost of driving or sinking, as well as to the securing an improved ventilation. But it may be doubted whether we are, even now, carrying our shafts and levels to their full and proper size to secure the advantages above-named. There appears to be too great a tendency among mine agents to direct the mines to carry levels only at a given height and breadth, irrespective of the character of the ground to be explored. A certain height and breadth, in which the men can move freely and transport their ores to shaft without inconvenience, may do very well in soft ground, but in hard blasting ground, where from 50 to 150 holes are bored and blasted to excavate a fathom in length, it may be doubtful whether it is wise to confine a level to 7 feet, or even to 8 feet high, and a proportionate breadth. The character of the ground should rather regulate the dimensions of the exploration. It will readily be admitted that, in all hard ground such as referred to above, the labour and materials expended in excavating a fathom of ground, is greatly in excess of, or out of proportion to, the bulk of rock removed, supposing the powder for the blast could always be deposited at the most advantageous point for it. And it must also be allowed that there is a great deal of abortive labour bestowed by even the most experienced miners, and that not from any carelessness or want of judgment on their part, but purely from circumstantial difficulties,—the peculiar nature and structure of the rock operated on. Thus a "kindly hole" often fails to "tear its burden;" and in the opinion of the writer the only effectual remedy that can be applied, is an enlarged space or excavation.

To illustrate this proposition, it is only necessary to refer to the modern mode of quarrying, by which it has been proved that by extending the scale of operations, powder and labour have been economised immensely. Of course the conditions under which the rock is blasted in a quarry and in a mine, are not properly the same; but the principle holds good in the one case as in the other, and to explain this principle it should be observed that the mode of operation is constant in all cases—that is, the effect of the combustion of powder in a given body of rock is as purely mechanical as that of splitting a rock by a wedge; for, although there may not be an appreciable point of time between the commencement and end of the combustion, yet in no case is the combustion absolutely instantaneous.

is an interval, during which the accumulating force exerts itself, he resistance is overcome, and the explosion takes place. If then the *operandi* of splitting a rock by powder is substantially the same as wedge, it follows that the conditions required to secure the full ιcy of the powder must be the same as those required in the use of the ; and with this view of it, it will be seen that in all hard and difficult large space is requisite to open to the charge the line of least resist- The character of the rock should therefore determine the size of the tion. A regular lode, though very hard to bore, may split very well n two well defined walls, or even with one ; but in cases of difficulty, often occurring in most large mines, when, to use a mining phrase, is no head nor bed," or when the natural cleavage or structural run adversely, then the difficulty is largely increased in a small tion. To make this as clear as possible, it should be remarked that ks are more or less crystalline, and, consequently, have their lines of e, termed by miners and quarrymen, "the grain of the ground." rain is along the line of the greatest number of the facets of the s: these facets, of course, differing in their size, direction, and the ion of their development; some being very minute, in the so-called t rock, they are even microscopic; but the crystalline structure in every rock, and the line of least resistance which the rock offers, ndent of walls and structural joints, is along the line of the greatest r of the facets.

, to find these, and plan the holes so as to follow them successfully, is, s rocks a very difficult matter, even to the most experienced of miners, a small level is almost impracticable: hence we have so many holes nd blasted to no purpose. A standing proverb, in olden time, among was "Pool adit," and many modern miners have had their own diffi- rs of ground to excavate as well; but there is reason to believe that ven would be penetrated much more readily if the level were carried nough to admit the miner boring his hole at the proper angle of tion so as to deposit the powder in accordance with the "grain" or line structure of the rock, and to give extended space for the ex- ; and this will apply to rocks of extraordinary hardness, and equally ting-ground in general.

e above views are correct, it is evident that it is not easy to define for our explorations, the enlightened judgment of all parties interested e the only guide in the matter, but it does seem that enlarged space ired in most, if not in all hard ground bargains.

want of good facilities for removing the refuse broken, is, perhaps, ediment in some mines, but this objection cannot remain in force in ning world long, as improved modes of winding are being generally aced.

onvince the miners of the truth of the foregoing remarks, may be a f some difficulty. To alter any system established and confirmed by actice of ages, will, in any case, require energy and perseverance; . metallic mines it may be expected to be especially the case, scattered, y are, over the world, with a widely divided management and a ng population.

ably, to convince the Cornish agents as well as the miners, that a wice as large, might in some cases, be driven cheaper than an ordi- ne, may be no easy task, but a temperate and persistent agitation of tter by those whose province it is to influence opinion, may accom- nuch.

ther and weighty reason why enlarged excavations should be made, improved ventilation of the mines which would result therefrom.

he early days of our mining experience, when levels were carried smaller than they are now, the air to work had to be forced into them machines; but enlarged levels, and a system of sinking winzes more

frequently, have removed these air-machines almost entirely; still, it must be admitted, that in very many mines—even in those best managed—there is room for improvement, and by enlarged levels this may undoubtedly be secured.

Pneumatics, as a science in relation to our metallic mines, is but imperfectly practised or understood. How to send a constant supply of fresh air to the end of the longest level upon natural laws, is a subject not so much studied by mine agents as it should be. Experience, however, teaches that in a small level the air and powder smoke lie stagnant, while in a large level a constant motion is obtained and kept up. In levels varying from 6 to 8 feet high, with proportionate breadths, the difference in ventilation is immense; in the larger level a current of fresh air will circulate inwards at the bottom of the level, and the impure air and noxious gases, of course, move outwards at the top of it; but in a 6 feet level the circulation is comparatively little.

I am, Sir, your obedient servant,
W. Vivian.

Pary's Mines,
April 17th, 1862.

OBSERVATIONS ON SILICA.

Sir,—In the "Observations on Silica," by Mr. Church, contained in the Magazine for April, I have noticed his remarks on the tendency of silica to deposit in a globular form, and would respectfully suggest that this form of silica, as seen in agate, chalcedony, and other stones, is purely the result of crystallisation—the system of crystallisation being the radiate—and is seen under a good microscope, either in opaque polished surfaces, or in thin sections, with transmitted polarised light. The mode of action being—that in passing from the fluid to the solid state, or condition, every atom of the silica arranges itself in radiating lines from the centre of the group outwards, and I am inclined to think, that the concentric rings, and so-called fortification lines, are the result of a modification of the atomic arrangement, rather than a change of substance in the deposition.

The globular form of deposition is not peculiar to silica: it is also seen in many other minerals—in stalactitic lime, in carbonate of copper (malachite), and in fact, in numberless combinations; but, from considerable observations on the subject, I have formed the opinion, that the globular, mamillary, botryoidal, and other kindred forms, are all the result of the central radiate system of crystallisation alone. Of course, they are modified according to circumstances; for instance, in a mass of matter, on the point of changing from the fluid to the solid, crystallisation may commence at several centres at the same moment, and the radiate crystals may advance outwards and press into the domains of their neighbouring centres, modifying their external forms considerably. This effect is beautifully seen in some malachites and agates, and a fine illustration of the process is witnessed in the crystallisation of some of the chemical salts under the microscope by the aid of polarised light.

Yours obediently,
W. Vivian.

Pary's Mines, near Bangor,
April 16th, 1862.

Sir,—In your magazine, No 4, page 241, the writer on "Faults, Dislocations, and Disturbances in Coal Mines," seems to confound the Ninety-fathom dyke with the Cock-field-fell dyke. I beg to observe that they are separate and distinct dykes. That designated the Ninety-fathom, is situated in Northumberland, while the Cock-field-fell dyke is in Durham.

I am, dear Sir,
Your obedient servant,
John Curry.

Boltsburn, Eastgate,
April 22nd, 1862.

Legal Notes.

On the 22nd March, the cross actions of *Island of Anglesey Coal and Coke Company v. Laurie*, and *Laurie v. Island of Anglesey Coal and Coke Company (Limited)*, came on for hearing at the Assizes at Beaumaris, before Mr. Justice Keating. The circumstances were these: early in 1860, the Company, being desirous of more capital, entered into negotiations with Mr. Laurie for the purchase by him of a moiety of their interest in their lease of the coal mine. An agreement was ultimately made, by which Mr. Laurie was to become the purchaser of one moiety for £5,000, to be advanced by sums of £1,000 every half-year. The Company's action was to recover the third instalment, which Mr. Laurie refused to pay. Mr. Laurie's action against the Company was for misrepresentation as to the value of the mine and the extent of their liabilities. The records in both actions were withdrawn, upon terms agreed upon.

On the 21st and 22nd March, the cause of *Hill and another v. Taylor and another*, was tried at the Derbyshire Assizes before Chief-Justice Cockburn and a special jury. The plaintiffs represented the Great Hucklow and the defendants the Mill Dam Lead Mining Companies. The litigation had already continued for upwards of a year and a-half in the Court of Chancery, and had now reached great proportions, the witnesses on both sides being upwards of fifty. The question to be decided was really a very simple one, namely, whether the defendants had the right to turn the water from their mine into a "swallow" existing in the Beech Grove Mine, belonging to the Great Hucklow Company. The latter contended that the "swallow" being in their ground, they had the exclusive right to use it; while the Mill Dam Company maintained that, as an ancient watercourse, they had a right to turn their water into it instead of pumping it to the surface. The evidence involved numerous questions of fact, and also as to the mining customs of North Derbyshire. Among the plaintiffs' witnesses, was Mr. Petherick, the eminent mining engineer, who had been commissioned by the Vice-Chancellor to make an examination of the mines. Mr. Petherick, proved that the water from the defendants' mines could not get to the "swallow" without going through what was indisputably the plaintiffs' ground; that the defendants had cleared out, but not otherwise altered, the "old man's drift;" and that, although the "swallow" was capable, under ordinary circumstances of easily carrying off the water from all the mines; yet that, under certain circumstances, it would have the effect of stopping the plaintiffs' mines.—After a considerable amount of evidence had been gone through, the Chief-Justice said: "I have a very strong opinion upon the case, which I think I ought to express before it goes further. I think I never heard or had to deal with a case of a more litigious nature than this. According to Mr. Petherick's opinion, it is quite clear, that some arrangements might be made by which, except upon extraordinary occasions, the whole series of mines might be drained through this "swallow." This day's proceedings cannot terminate the dispute between the parties, and what I want to suggest is, is it not possible to have this question settled without going through the long litigation which must follow if the case is not referred? I never felt so strongly upon a case, and I think some arrangement might be made by which some competent person shall be called in to decide upon what shall be done." After some consideration and delay, it was ultimately agreed to refer the whole merits of the case to Mr. Petherick, who should have power to call in a legal assessor, and take such means as he should deem proper to settle all questions between the parties, and decide the conditions upon which the "swallow" should be used.—The cross action of *Hewitt and another v. Hall*

and others, involving the same facts, was also agreed to be referred on the same terms.

On the 11th and 12th April, the arbitration in the important mining case of *Cottam v. Williams*, came on at the Hen and Chickens Hotel, Birmingham. At the last Stafford Assizes this case was set down for hearing, the plaintiff seeking to recover £1,600 for damage done to the Vulcan Iron Works, Greet's Green, by reason of the defendant's mining operations. The land upon which these works were built was originally sold by defendant, who, in the deed of conveyance, reserved to himself the right to the mines and minerals underlying the surface, and also made a provision that he should not be responsible for any results to the surface arising from the proper working of the mines. Soon after the opening of the case, Mr. Justice Crompton suggested that as some points of law would naturally arise for consideration by a higher court—and especially the point what was meant by a "proper working,"—an arrangement should be come to, by which the question should be referred to arbitration. The suggestion was acceded to, and Mr. Mathews (barrister) was named, and agreed to, as arbitrator, and this gentleman sat on the days named. The whole of the two days were occupied in hearing the evidence of the plaintiff and his witnesses; when it was agreed that an adjournment of three weeks should take place, in order to allow time for a compromise being arrived at.

The very peculiar case of Mr. Samuel Griffiths seems to have created considerable interest at Wolverhampton. This gentleman had been arrested on a *capias*, issued by the county court judge of the district under the provisions of the Absconding Debtors' Arrest Act, at the instance of Messrs. Hughes, on the allegation that he was about to leave the country. This allegation Mr. Griffiths denied; and he also contended that he did not owe Messrs. Hughes any sum of money now payable, inasmuch as he had obtained his protection under the arrangement clauses of the Bankruptcy Act, his deed of arrangement having been signed by 164 creditors out of 196, and thus made obligatory on the minority who did not sign. Considerable personal feeling seems to have been imported into the matter, and the statements and arguments before the county court judge were of a very lively description. Ultimately, Mr. Griffiths, being unable to submit to the delay, put in bail.

The next Sittings of the Stannaries Court will be held at Truro on the 14th May.

On the 24th April, a motion was made before Vice-Chancellor Sir W. P. Wood, on behalf of certain shareholders in the South Lady Bertha Mining Company, for an injunction to restrain proceedings at law, which had been commenced against them by persons claiming to be creditors, to recover sums alleged to be due for work and labour supplied to the company. It appeared that a petition had been presented to have the company wound up; that would probably be heard in a few days. In support of the application it was contended that, after the presentation of the petition for winding-up, there was inherent jurisdiction in the Court to protect individual shareholders from being harassed by creditors of the company, and that section 84 of the Winding-up Act of 1856 pointed to the same result. The Vice-Chancellor said that he had no jurisdiction to restrain these proceedings by creditors. It was true that the mere presentation of a petition for winding-up a company had the effect of staying all proceedings in the Stannaries Court; but that was applicable to the Stannaries Court only, and the Winding-up Acts expressly provided that a petition, or even an order for winding-up, should not have that effect. The motion must therefore be refused, and the *ex-parte* injunction that had been obtained must be dissolved, with costs.

In the case of *Oxlade v. the North-Eastern Railway Company*, Mr. Oxlade made an application in person to the Court of Common Pleas for a rule calling upon the North-Eastern Railway Company to show cause why an

tion should not issue, commanding them to deal with Mr. Oxlade, and ry coal for him in like manner to and from the same places and upon me terms as they carry for any other person. Mr. Oxlade read a ong affidavit in support of his case, the principal points of which that he had brought an action against the company for refusing to coal for him upon any part of their railway, and in particular from vell, Shincliffe, and Ferry Hill stations. The action was tried at Summer Assizes, 1860, when a verdict was given for the plaintiff with ges, and the special jury also found that the company were common rs. This verdict was afterwards set aside by the Court of Common from whose decision Mr. Oxlade appealed to the Court of Exchequer, ordered a new trial to take place. After considerable discussion, Chief-Justice Erle said: I think this rule must be refused. The of Exchequer Chamber have ordered a new trial, and I think this ought not to grant an injunction to command the company to carry the facts are more fully proved between you. That can be done by ew trial.—Mr. Justice Willes: I am of the same opinion.—Rule d.

the Birmingham Police Court, on April 22, the charge of E. B. Thorney- and Company against Mr. Izod and others again came on for hearing Mr. Kynnersley, stipendiary magistrate. The complainants were dward Bagnall Thorneycroft and another (Mr. S. Griffiths), trading the name of E. B. Thorneycroft and Company, and the defendants Mr. William Izod, iron merchant, Stafford-street, Birmingham; Mr. rick Hill, clerk to Mr. Izod; Jacob Poole, Wolverhampton, clerk to S. Griffiths; James Sutton, Wolverhampton, also clerk to Mr. S. ths; and Thomas Leighton, a boatman, living at West Bromwich. ase, which is a most peculiar and complicated one, was before the for two days, and was again adjourned. A cross-charge has been by Mr. Izod against Mr. Griffiths and one of his clerks. These —and indeed Mr. Griffiths' matters generally—create great interest district.

Notes and Queries.

Annales des Mines has now entered upon a 6th series: the 5th series l with the 20th volume.

e following is the production per head, of coal and iron, in each of the ipal European counties of the United States:—

COAL.	lbs.	IRON.	lbs.
eat Britain	5,550	1. Great Britain	285
lgium	3,950	2. Belgium	140
ussia	1,705	3. United States	60
xony	1,570	4. France	52
ited States	1,055	5. Prussia	50
ance	450	6. Bavaria	21
stria	200	7. Austria	21
varia	120	8. Russia	8
ssia	2		

ovisional protection has been granted to Mr. John Napier, of Glasgow, Improvements in Apparatus for Cooling the Water employed for ensing Steam or other purposes." The water, after being discharged the condenser, is caused to flow into a trough placed on the top. In the m of this trough a number of vertical tubes are placed, extending way upwards and downwards, open at the top, and made of any s material (or non-porous material, if they have small perforations all them) through which the water can ooze or percolate. Through these

a current of cold air is forced, which cools the water by coming in contact with it as it percolates through them.

Letters patent have been granted to Mr. John Watson, of Glasgow, for "Improvements in Furnaces," for heating boilers and other similar purposes.

Letters patent have been granted to Messrs. Edmund Suckow and Edward Habel, of Oldham, for "Improvements in Producing a Strong Blast or Current of Air." The inventors enclose an archimedian screw in a cylinder, and give it a rapid rotary motion, by which a strong blast or current of air is produced similar to an ordinary fan, but with a more powerful effect.

A miner's delegate meeting from the various collieries in Northumberland and Durham was held at Newcastle, on the 22nd March, and was well attended. It was reported that the miner's petition had been well signed. Statements were made by various delegates respecting the condition of the collieries in their respective districts—as to the number of shafts, and their condition—ventilating appliances, &c., affording information of considerable interest. The tone of the meeting appears to have been fair and moderate; but their success among the population of the different colliery districts seem to have been varied: one delegate reported the men at Rainton to be "as dead as a hammer with respect to their interests."

The Directors of the General Mining Company for Ireland, have apprised all zinc smelters (by advertisement) that they are now in a position to furnish in quantity regular supplies of calamine, containing a high percentage of metal. They state that the quality of the spelter made from this ore is of the first class, and very superior to that manufactured from blende.

Mining, Quarrying, and Metallurgical Intelligence.

CORNWALL AND DEVON.

The Royal Commissioners appointed to inquire into the condition of the metalliferous mines in the kingdom, with reference to the health and safety of the persons employed therein, have commenced their labours in Cornwall. The commissioners, consisting of Lord Kinnaird (chairman), Hon. F. Egerton, Mr. N. Kendall, Mr. H. A. Bruce, Mr. J. St. Aubyn, Mr. R. Davey, Mr. Headlam, Mr. P. H. Holland, and Dr. Greenhow, with Mr. Robert Temple, the secretary, have been staying at Liskeard, where they have examined witnesses from the neighbourhood of St. Austell and Par.

Miners' Association of Cornwall and Devon.—The Quarterly Meeting of the Miners' Association of Cornwall and Devon was held at Camborne, on the 9th April—Mr. J. F. Basset of Tehidy in the chair. The chairman announced that the President, Mr. Charles Fox, was prevented from being present, but he had written a letter, which would be read by the secretary. The following Papers were read:—

"On Winding," by Mr. J. Hocking, jun.

"On the Relative Merits of Skips and Man-engines for Raising and Lowering the Labourers in Mines," by Captain Josiah Thomas, of Dolcoath.

"On the Formation of Mineral Veins," by Mr. Reginald Grylls.

WALES AND THE BORDERS.

South Wales Institute of Civil Engineers.—The quarterly general meeting of the members of this Institute, was held at the Town Hall, Cardiff, on the 16th April—Mr. William Adams of Ebbw Vale (President), in the chair. The President stated that the officers who went out of office

during the ensuing year, were himself, as President, Mr. Menelaus, and Mr. T. Evans, as Vice-Presidents, and the members of the Council—most of whom were eligible for re-election. The Council were unanimous in recommending Mr. Thomas Evans, Government-Inspector of Coal Mines for the district, as President for the ensuing year; Mr. Menelaus and Mr. Adams (the retiring President) were also proposed as Vice-Presidents; Messrs. Basset, Martin, Greenwell, Levic, Rhys, Roberts, Cox, and Kirkhouse, as members of the Council; and Messrs. Williams and Brigden, as Secretary and Treasurer respectively. The following gentlemen were elected members:—Messrs. Frederick Davies, Aberdare; W. Child, Dowlais; J. E. Williams, Newport; W. H. Thomas, Swansea; and W. T. Lewis, Aberdare. The following papers were read:—

"On the Motions of Valves in Steam-engines," by Mr. Cope Pearce of Cyfartha, and "On Professor Jenner's Diagram, for showing the motion of the Slide Valve," by Mr. R. Schmidt. These papers being of an intricate nature, were ordered to be printed, the discussion being postponed to the next meeting.

The Paper by Mr. Mark Fryar, F.G.S., "On the Sanitary Condition of Mines," read at the last quarterly meeting (see M. and S. M., vol. 1., p. 51) was submitted to discussion. Mr. R. Bedlington, Mr. A. Bassett, Mr. Nasmith, Mr. Cox, and the President, took the principal part in the discussion, which went to show that, as far as South Wales was concerned, some of Mr. Fryar's remarks scarcely applied.

"On a plan to improve Canal Locks, and render Canal Carriage less costly," by Mr. G. Ashcroft. No discussion took place on this paper.

"On Giffard's Injector," by Mr. T. Dyne Steele, C.E. A discussion followed in which the author, Mr. Tomlinson (Superintendent of the locomotive department of the Taff Vale Railway), Mr. E. Williams, and the President took part. All admitted the practical success of the injector, but none seemed able to explain theoretically its action.

"On the Selection and Treatment of Coal for the Blast-furnace and Cupola," by Mr. Cox. The discussion was adjourned until the next meeting.

TRADE REPORT.—The Continental States still receive extensive supplies of iron from this district; the principal iron works in the neighbourhood of Aberdare, Merthyr, &c., have some good orders on their books, and the works are therefore actively employed. From the remarks which were made by some of the principal iron makers at the South Wales Institute, held last week, the trade has improved within the past two or three months, whilst there is every prospect of still further progression. Mr. Peters, in a good practical after-dinner speech, remarked that everybody must have been surprised at the large quantities of iron which had lately been exported to France, and when they considered that, comparatively speaking, but few things were made of iron in that country which should be, he considered that the recent free-trade measures would have a most beneficial effect, and that very large quantities of iron would be exported to that country for the general purposes of trade. The President (Mr. Adams, of Ebbw Vale), and other gentlemen present, held out cheering prospects for the South Wales iron trade, consequent upon the demand which must soon spring up for iron-plates to meet the requirements of the navy. South Wales was in a position to produce plates of any size and description, and in any quantities required, and it was believed that no other part of the country would be able to produce better or more enduring plates. The coal trade is not so brisk as it was some few weeks since, consequent upon a temporary depression in the shipping trade in the several ports, but there is a good demand in Newport for coals for the coasting trade. Since the opening of the South Docks, at Swansea, the coal trade has received a considerable impetus, which will be proved by the returns which have just been made of the quantities of coal shipped there

during the first quarter of the present year. The returns are as follow:—For January, 22,407 tons; for February, 21,056 tons; and for March, 24,226 tons; being a total of 67,689 tons for three months, or at a rate of upwards of 270,000 tons per annum. These shipments are exclusively in the South Docks, which would be lost to the port had not the docks been opened, for the trade in the North Docks is quite sufficient to keep the whole of the coal drops fully occupied. The foreign arrivals last week were larger than for some time previously, and the coal trade will doubtless soon assume its usual activity.

MIDLAND COUNTIES.

DERBYSHIRE.—The position of the iron trade is somewhat better, but there is nothing to indicate a state of activity. There is a general dulness in the hardware and metal trades, which is increased by the near approach of the Great Exhibition, parties being disposed to wait that time with a view of getting hold of the newest inventions. There is an increased demand for plates for shipbuilding, and Messrs. Brown and Co., of Sheffield, have received the order for the cupola plates recently adopted by the Government. There is a greater demand for rails for our home lines; and from what is doing on the Continent we may expect shortly to receive large orders from our colonial possessions. The coal trade is very dull, and in many of the colliery districts there is great privation experienced, much greater than has been known for years past. Some of the collieries are not working more than half-time, and this, coupled with the fact that wages have been reduced 10 per cent., makes the condition of the operative collier a very depressed one. So long as the cotton and woollen trades are depressed there is no hope of improvement. There is not half the quantity of coal being sent from Derbyshire to the manufacturing districts this year as compared with the last.

SOUTH STAFFORDSHIRE.—An admirable tone continues to pervade the iron market of South Staffordshire. In Birmingham, more particularly, this was quite perceptible. On every hand there seemed a conviction that business would soon show a very decided improvement. A heavy demand is sure to be soon experienced in this country for iron and hardware for all continental markets, should events fulfil the expectations that are now being indulged in relative to the working of the Anglo-French Commercial Treaty. And, as has been anticipated, the past three months' trade of the ironmasters of England, with the consumers of the metal that they produce, is eminently stimulative of the warmest anticipations. All this is totally independent of the great work in which we have begun to be engaged, and which our own witty historian of the present day has so admirably caricatured in his cartoon for this week. Truly Vulcan is arming Neptune, and as heretofore that Vulcan must ever be Great Britain. "Come on who dares or can, long ranges or close quarters, we're his men." Many a finger in South Staffordshire is itching to take a prominent part in the conflict, but prudence is more than ever a distinguished feature of the conduct of the ironmasters of this district. Plates have been produced here that have been reported very favourably upon by the Iron-plate Committee, inasmuch as the face of the plates received a 40 lb. shot at one hundred yards without showing any sign of cracking; but the back, which seemed to be harder than the front, cracked across. Then the welding was not complete, but it had been better done than has been the case with much of the iron sent to the committee. Defective welding is spoken of by Captain Dyer, the secretary to the committee, "as invariable in all plates," but, he adds, that in the specimens of which he was writing—was furnished by Mr. S. Millington, of Tipton—this defect was "not nearly so apparent as in many the committee have tried." A conviction is felt here even more strongly than it was felt last week, that in this district we can produce iron

that shall be above successful competition, if the authorities will only pay us a fair price for our stuff; and there is little doubt but, so soon as the question assumes a more definite shape, South Staffordshire will enter the market with vigour, and produce iron adapted to shifting land fortifications as well as to floating batteries, for the day of land fortifications upon which guns may be moved to sweep all points is not yet at an end. Perhaps, however, a stronger influence for good than any fact that we have yet recorded is being exercised by the conviction that is gaining upon all minds that we have arrived at the end of one of those epochs in the history of commerce which signalise the commencement of a new epoch, with an increase of trade and a rise of prices that will continue to move in a right direction until, some five or six years hence, the culminating point will have been reached, and we shall begin again to retrograde, till at the last two or three years of the decade we find ourselves as we have recently been, silting at the bottom. Although there has been a slight fall in the week in Scotch pigs, yet the great rise of the past month in that most sensitive article of commerce is indicative that it is now being used for purposes of investment by capitalists. Coal, of first-class samples, is in good demand at the leading houses.

NORTHERN COUNTIES.

NORTHUMBERLAND AND DURHAM.—The *Colliery Guardian* gives the following review of the trade of this district towards the end of this month. This being Easter week, and the holidays interfering with business somewhat, there is nothing remarkable to report about the condition of trade in this neighbourhood. We contrive to keep up the increased activity, and the aspect of commercial affairs is decidedly better than it has been at any previous time this year. The coal trade is, however, flat, only the household and coking collieries doing much business. The gas-coal collieries, which have been moderately well employed all winter, are feeling the effects of the long-light evenings, for, as the days extend, their working-days shorten, and in a few weeks they will arrive at their slackest season. A local paper, in speaking of the rapid development of the Cleveland district, says:—"All works in the neighbourhood are fully employed, and as the year advances no doubt the export trade will increase. One fact worthy of note in connection with the trade in this district is, that whereas in 1860 only 30,000 tons of iron were shipped to France, yet in 1861 somewhat over 90,000 tons were despatched to that country, showing the benefit the ironmasters and trade in general of this district have derived from the French treaty, which has in a great measure compensated for the falling off of the American trade Two of the principal firms are at present engaged in the execution of large orders for railway chairs for the South of France, and the shipments that have been made so far as the year has advanced, have principally been to that country: so that there is every reason to expect that this year will fully come up to last, if not surpass it, and with the advance iron has got this last week or two, it will encourage the manufacturers to push their trade more in this district. A Staffordshire firm, wishing to share in the prosperity enjoyed by the Cleveland district, is said to have purchased 200 acres of land at Grosmont, near Whitby, for the purpose of erecting blast furnaces, the ironstone in that district being supposed to be rich, but not so thick in the strata as the more northern parts of the Cleveland bed, which has its terminus near Middlesbro'. There have already been some unfortunate works erected in this district at Rosedale. The blast furnaces and engine-house, built on a bad foundation, gave way and fell over. We hope the Messrs. Bagnall, who are the purchasers of this new royalty, will be more fortunate than their predecessors. Mr. Snowdon, late of the firm of Snowdon and Hopkins, Tees-side Iron Works, Middlesbro', Mr. Leeman, solicitor, York, deputy-chairman of

the North-Eastern Railway Company, and Mr. Muschat, coal-owner, are stated to have purchased a plot of land adjoining the above works, for the purpose of erecting steel works. Whether these gentlemen intend to manufacture steel in all its different kinds, similar to some of the large Sheffield firms, or intend merely to manufacture steel plates for ship and boiler purposes, we are not in a position at present to say. Now that there has become such a demand for armour plates, and the resources of the Cleveland district being fully able to cope with undertakings of this kind, should those gentlemen go into this trade we see no reason why they should not succeed, especially as we know that the Cleveland plates are quite able to bear the tests submitted to them by the Government in all their different forms." The exports from the Tyne last week included 39,790 tons of coals; 2,341 tons of coke; 3,699 cwt. of iron, and 10,325 cwt. of alkali, being an increase of 5,334 cwt. in the shipments of alkali, and a decrease in the shipment of coals of 1,153 tons; coke, 180 tons; iron, 6,005 cwt. Among the imports were 16 tons of scrap-iron from Oporto, and cargoes of pit props, &c., from Christiansand and Arendahl.

Yorkshire.—Some years ago a poor fisherman travelling in the neighbourhood of Rosedale, Yorkshire, found a stone of a peculiar character, which he gave to some gentleman who caused it to be analysed, and found it to contain an immense proportion of rich and valuable iron ore. This was the discovery of the now well-known Rosedale Magnetic Ore, of whose extent and duration no calculation can be made. Not many years since a company leased 8,000 acres of land in Rosedale, and commenced to work out the mineral wealth of the district on a large scale. They have been very successful, and at the present time their usual output is from 10,000 to 16,000 tons per month, or a quantity capable of producing from 60,000 to 80,000 tons of pig-iron per annum. The ore is of three principal varieties—the brown, yielding 51½ per cent.; the dark blue, 43 per cent.; and the light blue, 39 per cent. of iron. One of their chief customers is Mr. Morrison, of Ferry Hill furnaces, and the company contract to supply this gentleman with ore yielding on the average 44 per cent. of iron, which is a trifle under the average percentage of the varieties named. Last week a number of gentlemen, including directors of the North-Eastern Railway, and gentlemen connected with the iron trade, had a trip along the newly-opened Rosedale Branch Railway to visit the works of the company. Amongst them where the Lord Mayor of York (Mr. Leeman); Alderman Hartley, of Sunderland; and J. Pulleine, Esq. (directors of the North-Eastern Railway); Mr. Morrison, of Ferry Hill; Alderman J. L. Bell, Mr. John Rogerson, Mr. John Cochrane, and Mr. Millar, of Newcastle; Mr. Cail, the Rosedale Branch contractor; Mr. Sheriff, Worcester; Mr. J. H. Leeman, and Mr. Isaac Harties, of the Rosedale Mining Company; Captain O'Brien and Mr. Cabry, York; Mr. Stobart, Mr. Webster, and Mr. Ord, of Sunderland, and others. Arrived at the mine the party entered, traversed the galleries, headways, and bords, and at the principal workings of the magnetic ore applied the magnet, and held the iron ores in suspense. After the inspection the party dined together at Rosedale, under the presidency of the Lord Mayor of York.

SCOTLAND.

Mr. Ferrie having declined the appointment of Government Inspector of coal-mines for the eastern division of Scotland, the Secretary of State has conferred it on Mr. Ralph Moore. This gentleman having satisfactorily passed his examination under Mr. Warington Smyth, has entered upon the duties of his office.

A very valuable series of papers has appeared for some weeks past in the *Colliery Guardian*, from the Scotch correspondent of that Journal. Some of these papers are really very able essays.

COLONIAL AND FOREIGN.

We have received the Government reports, papers, and acts on the Nova Scotia gold-fields, but too late for notice this month. We have also received some private communications on these districts, of which we will give an abstract next month.

A Company called the South Greenland Mining Company has been formed for the purpose of working mines of copper, tin, lead, and other minerals in South Greenland. Mr. W. C. Vivian, the mining broker (Vivian and Reynolds) is the engineer.

A company has also been formed for working the Great Copper Lode of Huacayvo (Mexico); Mr. G. C. Hockin is the Chairman, which may be considered a guarantee of the *bona fides* of the concern, as Mr. Hockin is a director of the Anglo-Mexican Mint, and well acquainted with that country.

The Labuan Coal Company have issued a report to their shareholders containing a very satisfactory statement from Mr. Sinclair, their new manager, to the effect that it was expected to get coal ready for delivery at the jetty to vessels calling at the island during the present month, and that he has no doubt that from the present seams 100,000 tons can be worked yearly for ten years if the requisite amount of labour can be procured.

At a meeting of the New Granada Company, a report was presented, stating that the new manager had arrived at the Frontino Mines in May last, and that his report upon that property corroborates the favourable opinions of the directors as to its value. The political disturbances in the republic, however, have not only interfered with industrial operations, but have likewise almost entirely stopped communication between the coast and that part of the country where the company's business is carried on, and suspended for many months the forwarding of remittances from the mines. The produce of ore has also been diminished in some degree, from the impossibility of transmitting gunpowder and other necessary stores. The cost of working, on the other hand, has not been lessened in nearly the same proportion. The agents continue to speak highly of the intrinsic value of the company's property. With a view to the introduction of an improved system of working and for other purposes, the directors were authorised to borrow 5000*l*. in debentures.

UNITED STATES.

The *United States Railroad and Mining Register* gives the following, on the coal trade of the United States:—During the official and navigation year, 1861, the six outlets to the general tidewater market, from the three anthracite regions, divided the coal tonnage forwarded, in these proportions, to wit:—

	Tons.	
Philadelphia and Reading Railroad	1,460,832	
Schuylkill Canal	1,183,570	
Total from Schuylkill region		2,644,402
Lehigh Valley Railroad	743,672	
Lehigh Canal	994,705	
Total from Lehigh region		1,738,377
Delaware, Lackawanna, and Western R. R.	1,104,319	
Delaware and Hudson Canal	1,356,301	
Total from Lackawanna region		2,460,620
Total tonnage six lines from three regions		6,843,399

The percentage of this grand aggregate forwarded from each region was:—

From the Schuylkill region	38·64 per cent.
From the Lehigh region	25·40 per cent.
From the Lackawanna region	35·96 per cent.
	100·00 per cent.

To the first of July, in the season of 1861, there were forwarded to market over the Delaware and Hudson Canal 432,028 tons, the whole of these shipments having occurred in the months of May and June. If, this present year, parties interested in the transport of coal - for when loss is incurred it usually falls upon the transporters —had combined together and contracted with the Delaware and Hudson Canal Company for all the coal produced from the mines of said company, and forwarded over its canal in the months of May and June, at a fair and full price, then said company, upon such price as a basis, could have imposed a remunerating rate of toll upon the tonnage shipped for the Pennsylvania Coal Company; the general market would thus have been protected and the entire trade would have prospered throughout the season. But the opportunity was permitted to slip by, and, as a consequence, all the carriers to the market in which the competition prevails, are transporting coal at reduced rates, or under a schedule of drawbacks which diminish net income. Moreover, as the great carriers now understand and appreciate their relative positions in and towards the common market, it seems to us they might agree among themselves to bind each line not to forward coal tonnage in excess of a prescribed percentage of the aggregate supply. The six carriers can surely agree upon the quantities that shall be forwarded, even if they cannot control prices in the market. And, as upon stipulated quantities they could impose charges that would assure a just return and measure of income, the shippers (being thus cut off from the reduction in transportation expenses) would be constrained to keep up the prices of coal in the market, and make the consumer pay all expenses justly and fairly a part of the cost of production; whereas now, in the event of embarrassment in the market, the shipper appeals to the carrier to reduce the charge for transportation, so that he may furnish coal to its consumer at prices below cost, the carrier parting with a profit equal to the reduction made, and which tends to the sole benefit of the consumer, who should pay a price covering all charges accrued against the article on its arrival in the market. We believe if the six carriers would treat upon the quantities as a basis, in lieu of prices, they could control the market; for by rail and canal quantities could be forwarded in trains and through locks, according to stipulation laid down in a compact; then, if operators and dealers would cut under in prices, the reduction would be their own loss, and would not, as now, come off the carrying lines. Besides, as the market could not be overstocked under the plan proposed, the general tendency of the operations in the market would be towards a maintenance of remunerating prices, for dealers are not over fond of doing business at a loss to themselves, especially where and when it is within the compass of their efforts to realise gain and character out of the same transaction.

Metal Markets.

The following weekly reports from Messrs. Von Dadelszen and North, show the position of the metal market during the month:—

April 3.—Copper.—The market has become easier, and 10¾d. is the smelters' price, while some second-hand lots are to be had at 10½d. Foreign was affected in the same way as English, and the price of Burra advanced from 94*l*., which was the very lowest, to 97*l*. 10*s*.; the market is now a shade easier, and there are sellers at 97*l*. Kapunda is held for 98*l*.; Spanish, 90*l*.; and Chili 88*l*. to 89*l*.

Tin.—In English tin official prices are maintained, but there has been and still is underselling, the demand being slack. Straits has only been sold in small quantities for export and consumption at 117*s*. for fine; there are now sellers of this, but no buyers of any quantity. Little or no business

has been doing in the market for Banca; the price is nominally 125*s*. In Holland very little done—f. 73½ the present price.

TIN PLATES.—There have been extensive shipments from Liverpool, and makers continue to be very fairly supplied with orders, but the prices are low, and future prospects of the trade bad. We quote charcoal from 26*s*. 6*d*. to 28*s*. 6*d*., and coke 22*s*. to 24*s*., in London; 6*d*. less for delivery in Liverpool.

LEAD.—The market and demand have been very dull, and prices are on the decline.

SPELTER.—The market is now dull, but not lower in price; for Hull parcels 18*l*. 5*s*. is the price.

April 9.—The dull state of the metal market since our last report has increased rather than diminished, and with the exception of Scotch pig iron, which has been very excited, other metals have all a more or less downward tendency.

IRON.—Welsh bars are in moderate demand at 5*l* f. o. b. Wales, and at about 6*l*. per ton here, and 5*l*. 15*s*. to come forward. Staffordshire very quiet. A very large speculative business has been done in Scotch pig iron; on Monday last as high as 54*s*. cash was paid, but yesterday as low as 53*s*. was accepted, at which it closed rather flat.

COPPER.—For manufactured 10¾d. is firmly asked, but cake and tile are obtainable at 95*l*. Foreign is easier. Burra has been done at 96*l*., and still obtainable at it. Kapunda 97*l*. nominal. Chili 88*l*. to 89*l*.

TIN.—English dull, the demand slack. Foreign is lower. We have sellers of straits at 115*l*. Buyers looking on. Banca is nominally 125*l*. The Dutch market dull at 73f.

TIN PLATES difficult to dispose of, the American market being overstocked; the prospects are any thing but bright for manufacturers.

LEAD remains very dull; good English pig 19*l*. 10*s*. to 20*l*.

SPELTER.—The business done hardly calls for any remark, holders at 18*l*. 10*s*. for parcels on the spot here, but 5*s*. less would not be refused. Hull lots 18*l*. 5*s*. to 18*l*. 7*s*. 6*d*.; special brand 18*l*. 10*s*. W.H. 19*l*.

April 16.—There is no feature of interest to report in the metal market. Dulness has predominated, the demand has materially fallen off, and if it were not for the cheapness of money, which enables holders to look out for better times, several kinds of metals would have further receded in value.

COPPER.—Both English and manufactured can be bought under official quotations, and although the last telegram from India brought better amounts, it has as yet had no effect on this market. In Burra, owing to lower prices, a good business has been done at 95*l*., at which there are still sellers—Kapunda is held for 96*l*., Chili in Liverpool 88*l*. to 89*l*.

TIN.—English in fair demand, without alteration in value. Straits is very flat with sellers at 115*l*.; buyers shy. Banca nominally 124*l*. The Dutch market, after touching 72f., was nominally recovered to 73f.

TIN PLATES remain dull of sale, prices unaltered.

LEAD.—No change for the better to be reported.

SPELTER.—The transactions have been very few, but prices are fairly maintained. We quote spot here 18*l*. 7*s*. 6*d*. to 18*l*. 10*s*. Hull parcels have changed hands from 18*l*. 5*s*. to 18*l*. 10*s*.; according to brand, W.H. 19*l*.

April 23.—The Easter holidays have somewhat interfered with the regular course of business, but, independent of this, the metal market has not shown any signs of reanimation. Welsh bars are in a fair but moderate demand, at about 5*l*. per ton f. o. b. in Wales; from 5*l*. 17*s*. 6*d*. to 6*l*. f. o. b here.

COPPER.—The last Indian advices are somewhat better for this metal, but shipping orders are below present prices. We quote manufactured at from 10½ to 10¾. Tough cake and ingot 94 to 95. Burra has been sold as low as 94*l*. 10*s*., but it is now held for 95*l*. Kapunda nominally 97*l*. Chili 87*l*. to 88*l*. in Liverpool.

TIN.—English was officially reduced on the 21st inst. 3*l.* per ton, both for refined and common. Foreign, although it has not gone down quite to the same extent, is very flat. Straits can be had at 114*l.*, and we did hear of 113*l.* being accepted for an export order. Buyers are still very cautious. Banca being held for 124*l.* effectually prevents any business. The Dutch market is flat at 73f. sellers.

TIN PLATES are very dull of sale; prices from New York come very low, which will prevent any export of magnitude.

LEAD is dull, without any change in value.

SPELTER has been very quiet, but firmer. Holders ask 18*l.* 10*s.* for parcels on the spot here; a limited business done at 18*l.* 7*s.* Some favourite brands in Hull have changed hands at 18*l.* 10*s.*, at which we close sellers; buyers 5*s.* less. WH 19*l.*

Metallic-Ore Markets.

TIN.—During the last month the standards for black tin have again declined 2*l.*, which makes a reduction of about 32*l.* per ton on refined tin during the past two years. The standards now stand at—

Refined	£102—105
Common	101

The stocks are reported as heavy, and the market remarkably dull.

COPPER.—At the four Cornish sales we give this month, the number of tons, average produce, quantity of fine copper, average price per ton, and standard, have been as follows:—

Date.	*Tons.*	*Produce.*	*Fine Copper.* Tons. cwt.	*Price per ton.*	*Standard.*
Mar. 27.	4,108	6¾	262 6	£5 3 0	£123 14 0
Apr. 3.	3,907	6	234 10	4 17 6	127 5 0
„ 10.	2,558	7	179 8	5 17 0	122 12 0
„ 17.	5,286	6¼	328 10	4 19 6	124 7 0

According to the standard calculations, on March 29, there was a decline of 1*l.* 10*s.* or 1*l.* 12*s.* in the standard compared with the previous sale. At the sale of April 3, there was an *advance* of 1*l.* or 1*l.* 6*s.* At the sale of the 10th, according to the *Mining Journal*, there was a *decline* of 10*s.*, but according to the *West Briton*, the standard remained stationary. At the sale of April 17, there was a decline of 1*l.* 2*s.* or 1*l.* 5*s.*

LEAD.—Comparing the sales of lead ore for the month with those of the former month, there appears a decline ranging from 10*s.* to 15*s.* per ton.

London Share-Market.

THERE has been a very large amount of business transacted during the past month. Notwithstanding the interference of the usual Easter holidays, money has become tighter from the increasing demands for Foreign loans, which have absorbed a large portion of the unemployed capital.

The details of the operations in shares will be gathered from the following:—

Alfred Consols offered very freely at a nominal price.

Cook's Kitchen shares have been more offered for some days past; they are now weaker in character, but the mine is reported to be looking most favourable.

Clifford Amalgamated have been steady at 29-31.

Camborne Vean declined to 1⅞-⅛.

Carn Camborne has remained very steady at 11/. to 13/.

Craddock Moor very scarce, only one or two shares having changed hands: the price is firm at 29-31. Devon Great Consols have been much sought after, but holders do not seem inclined to part with their shares, as the many orders to buy have been returned unexecuted: they close at 420-30. East Basset continues dull in character, at lower prices. East Caradon, after touching 40, receded again to 38¾-9¼, at which they close. A very large amount of business has been done in these shares at various prices between 35 and 40: the latest reports from the agents give the valuations of the ends as follow:—the 50 east, 70*l.* per fm.; 60 east, 50*l.*; Fawcett's lode, 15*l.*; new lode 8*l.*; 60 west, worth 40*l.* per fm.

East Carn Brea have been largely dealt in at 12¾-13¼, the mine is looking promising for further improvement. East Grenville, steady at 30*s.*-32*s.* 6*d.* Great Fortune have been in great request, and close very firm at 25-6. Great South Tolgus have been in demand and closed firm.

In Herodsfoot only a moderate amount of business transacted, the price remains steady at 37-8. Hingston Down shares have been very flat for some time past, with scarcely any business doing: Marke Valley remained very firm and steady at 10⅛-¼; the mine continues to look well, and the samplings are kept up without intrenching on the reserves. New Seton in considerable request, and advanced to 80-90. North Downs declined to 3¾-4, there have been numerous dealings in these shares throughout the month, but there has been a preponderance of sellers. North Basset scarcely inquired for. North Treskerby have fluctuated a great deal, and close 23-4. North Crofty advanced to 3¼ buyers, but close 2¼-½, inquired for.

In Providence shares, there has been very little business done during the month; the price has become lower towards the close, being 40-1. Rosewall Hill and Ransom have been largely dealt in, but closed rather weak at 3¼-¾. South Tolgus occasionally sought after. South Caradon are firm at 335-40, with a limited number of transactions. South Frances weak in character, at present quoted 97½-102½. Stray Park very firm at 31-3.

Tincroft greatly in request, and shares advanced to 12¼ buyers, but declined again to 10½-11½, at which they close. Tamar silver lead, very dull at present. West Caradon weak at 30-2. West Rose Down are eagerly picked up by investors. The prospects of this mine are very encouraging, as the sett adjoins Marke Valley; the shares are now 15-16. West Seton weak. Wheal Grylls have advanced to 33-5, the supply of these shares has been very scanty for some time past. Wheal Bassets, 97½-100 with a little inquiry. Wheal Grenville after remaining quiet at 2⅝, have recovered, and advanced to 3½ buyers, owing to an important discovery of the winze sinking below the 90. Wheal Uny firm 7½-¾. In Wheal Ludcott a very large number of shares have changed hands at advanced prices; they close 5¼-¾. Wheal Margaret rather weaker, at the close 45-46. Wheal Mary Ann, very flat. Wheal Setons have been dealt in to a considerable amount, they close 133-5. Wheal Trelawny close weaker than they have been, viz., 16-17. Wheal Basset dull, 11-12. Wheal Unity have been in request, and close 13/.-14/.

South Phœnix shares have been in request during the last few days, and have improved to 2¾-3¼; this mine is situated near Marke Valley and West Rose Down, and a cross-cut is at present being driven to intersect the Marke Valley lodes, which, it is expected, will occupy about six months yet.

In Welsh mines there has been a good business done. Bryn Gwiog, 27 buyers. At Billins, the lode in the shaft sinking west is producing good lead one ton per fm., and improving; the shares are 17-18 Longrake rather quiet, 12-14; at the meeting a call of 1*l.* per share was made. North Minera with very few inquiries.

In foreign mines there has been an average amount of business done in the Stock Exchange. St. John del Reys have declined to 52-3, and many transactions have taken place. United Mexican remain tolerably steady at present at 7-½. Great Northern Copper have declined and closed. East del Rey steady at 1½-¾. Port Philip, 1-⅛, with occasional dealings. Scottish Australian have been in considerable request, and close at an advance 2⅛-⅜. North Rhine rather improved owing to better reports from the mine. Maraquita have been dealt in at ⅞. Dun Mountain, firm at 1⅛. General Mines steady, 22-24. Worthing, not much doing, ½ to ⅝. Bon Accord, very dull at ¼-½. Fortuna, 2-2½. In Cobre Copper, Linares, Kapunda, Brazilian, Lusitanian and Pontgibaud very little business doing, and scarcely any variation in prices.

Tuesday, *29th April*, 1862, 4 P.M.

The following are the closing prices furnished by Messrs. Webb and Geach: —

The usual fortnightly settlement has somewhat interfered with to-day's business, the markets have not therefore been very active. Nevertheless, there was a fair business done in East Caradon, Great Fortune, North Downs, Wheal Seton, Marke Valley, East Carn Brea, and South Phœnix.

Carn Camborne, 12/. to 14/.; Camborne Vean, 1⅜ to ½; Cook's Kitchen, 33 to 34; Devon Great Consols, 420 to 30; East Basset, 41 to 3; East Caradon, 39 to ½; East Carn Brea, 12¾ to 13; East Grenville, 30/. to 32/6; East Jane, 2 to 3; Great Vor, 6¾ to 7; Great Fortune 26 to ½; Herodsfoot, 37 to 38; Marke Valley, 10⅛ to ¼; New Seton, 30 to 90; North Downs, 37/8 to 4/8; North Treskerby, 23 to 24; North Crofty, 2⅜ to ½; Providence, 40 to 42; Rosewall Hill, 3½ to 3¾; Rosewarne United, 19 to 21; South Phœnix, 2⅞ to 3⅛; South Caradon, 335 to 40; South Frances, 97½ to 100; Tincroft, 10½ to 11; West Caradon, 31 to 32; West Rose Down, 14 to 16; West Seton, 260 to 70; Wheal Grylls, 32 to 34; Wheal Basset, 95 to 100; Wheal Grenville, 3½ to ⅝; Wheal Uny, 7⅛ to ¾; Wheal Kitty, Lelant, 10½ to 11½; Wheal Ludcott, 5¼ to ½; Wheal Margaret, 45 to 6; Wheal Mary Ann, 11 to 12; Wheal Polmear, 17 to 19; Wheal Seton, 133 to 5; West Tolgus, 30 to 5. *Foreign Mines*:—East del Rey, ⅜ to ⅝ prem.; St. John del Rey, 52 to 4 prem.; United Mexican, 7¼ to ½; Port Phillip, 1 to ⅛; Gt. Northern, ⅜ to ¼ dis.; Santa Barbara, ⅛ to ⅜ dis.; Capula, ⅛ dis. to ⅛ prem.

Provincial Share Markets.

DUBLIN.—The following report is condensed from the *Mining Journal*:—Towards the end of March, the Wicklow Copper Mining Company shares slightly improved, from 50*l.* 15*s.* to 51*l.*, at which price they were in request. The Mining Company of Ireland shares a trifle lower, 18*l.* 17*s.* 6*d.* being offered, and holders demanding 19*l.* 5*s.*, an abatement of 2*s.* 6*d.* on last

quotation. General Mining Company for Ireland shares changed hands at 4*l*. 10*s*. leaving off sellers. Business was done in Connorree shares at 33*s*. Great excitement was got up in favour of Carysfort shares, which rose from 9*s*. 6*d*. to 12*s*., and have since advanced to 20*s*., but fallen back to 15*s*. (15*s*. paid), or par. Sales in fully (2*l*. 10*s*.) paid up shares where effected at 1*l*. 15*s*., or at an improvement of 10*s*. per share, but still at a discount of 30 per cent.

In the beginning of April, the Wicklow Copper Mining Company's shares were fully 1*l*. lower than last prices of 50*l*. 15*s*. to 51*l*., from which they have gradually fallen to 49*l*. 12*s*. 6*d*., buyers. The steadily progressing prosperity of the Mining Company of Ireland, whose directors and managers, like those of the Wicklow Copper Mining Company, pay more attention to the genuine improvement of their mines and general affairs than to ruling the share market, prevents the prices of their shares fluctuating much; they closed 18*l*. 17*s*. 6*d*., buyers, and continue in request at that price, with a tendency for a slight rise. Connorree shares are heavy, and so are Carysfort.

Further on in the month, Wicklow Copper Mine Shares were nominally quoted at from 45*l*. to 47*l*. The Mining Company of Ireland shares suffered least from the prevailing dulness in mine securities, and were readily bought at a fraction under 18*l*. for cash, and at 18*l*. for new account. The prospects of these mining properties render investments in them at the present price safe and promising. Carysfort shares offered at 13*s*. 6*d*., and Connorrees easily procured at 31*s*. 6*d*. In General Mining Company for Ireland shares little or no business doing.

Later in the month, the announcement of "no dividend this half-year" by the Directors of the Wicklow Mine Company, cast a temporary gloom upon the shareholders, and the price of the shares fell as low as 44*l*. But on quietly reviewing the excellent prospects for the future, buyers became predominant, and shares rose again to 48*l*. There will, of course, be a variety of opinions as to the time the American war will continue, and the price of these shares will fluctuate accordingly; thus they have again fallen back to 47*l*. 10*s*., sellers. At Carysfort, an improvement has taken place in their Ballintemple Lead Mine, which holds out promises of proving profitable; but the produce is as yet small, nevertheless it has tended to give firmness to the price of the shares, steady at par, or 15*s*. In General Mining Company for Ireland shares several transactions at 4*l*. 12*s*. 6*d*, and 4*l*. 15*s*. sellers. A rumour of Knockmahon Mines not looking so well as hitherto had a depressing effect on the shares of the Mining Company of Ireland, which fell at one time to 16*l*., from which they, however, recovered to 17*l*., at which all would be taken that offered. Connorree shares flat.

Towards the end of the month, a few transactions took place chiefly in Mining Company of Ireland and Wicklow Copper shares; the former touched 17*l*. 10*s*., but receded to 17*l*. 2*s*. 6*d*., freely taken at 17*l*.; the latter, or the Wicklow Copper Mining Company's shares, moved back to 46*l*., in request. A few transactions took place in Carysfort shares (last call, or 20*s*. paid), at 19*s*., or 5 per cent. discount. Connorree shares were ineffectually offered at 32*s*. In General Mining Company for Ireland shares no business noted. At the Wicklow Copper Mining Company's ordinary half-yearly general meeting, on Wednesday, the directors' reports and accounts, made up to March 1 last, were laid before the shareholders. The Chairman stated to the meeting that there had recently been symptoms of improvement in the alkali trade in England, and he trusted it would ere long compensate the shareholders for their temporary sacrifice of a dividend. Mr. Octavius O'Brien, to whom a vote of thanks for important services rendered to the company was passed, suggested that the establishment of chemical works by this company would prove a source of profit, and have at least the effect of checking the extraordinary fluctuations in the prices of sulphur.

EXTRACTS FROM MINING CIRCULARS.

From MESSRS. WEBB AND GEACH, 8, *Finch Lane, London.*

THERE has been an average amount of business transacted during the week, notwithstanding the interference of the Easter Holidays. The demand has, however, been confined to a few mines, such as East Caradon, Marke Valley, Ludcott, East Carn Brea, Cook's Kitchen, North Treskerby, North Downs, North Crofty, Providence, South Caradon, Devon Consols, Stray Park, Tincroft, Wheal Grenville, Wheal Uny, Wheal Polmear, Wheal Margaret, and Wheal Seton, in each of which there has been a fair amount of business transacted. East Caradons remain very firm, although the highest prices of last week have not been maintained, as they then touched 40*l.*, but have receded a little, and close 38¼-¾. Comparatively speaking, there are scarcely any shares offering on the market, as the public continue to buy them for investment, and thus the supply is very meagre. Marke Valleys have advanced since the meeting, and are now tolerably steady, at 10⅛-¼. East Carn Brea continues firm, at 12¾-13. At the meeting the cash account showed a balance of 186*l.* against the mine, but the estimated receipts and expenditure for the next two months showed a balance of about 2,200*l.* in favour of the adventurers. The report of the agent pointed out the favourable progress made in the various workings during the past two months, and also expressed the great confidence felt by them in the future prospects of the mine. Wheal Ludcotts have been in rather extraordinary request, and have risen to 5½-6. The accounts presented at the last meeting were considered highly favourable, and the mine is reported to be making good progress. Cook's Kitchen have been more offered, and the price has declined to 33-34. North Treskerby occasionally inquired for, they remain tolerably steady, at 23-4. North Downs very flat, and declined to 3⅝-⅞, but close firmer. The market seems to be chiefly sellers of these shares, hence the drooping tendency. North Crofty, having advanced to 3¼-⅜, have become weaker, and close 2⅜-⅝. Providence steady, at 41-2. South Caradons very scarce, 332½-7½. Devon Consols also inquired for, but no sellers at present on the market. Stray Parks, 32-4. with fair business doing. Tincroft suddenly advanced to 12-13; they close 11½-12½, with more buyers than sellers. Wheal Grenville remain firm, at 3-¼, shares very scarce for immediate delivery. Wheal Uny inquired for, 7½-8. Wheal Polmears have been inquired for during the past few days, but at present there are no sellers on the market; the mine is said to be looking very favourable; they close 18-20. Wheal Margarets have been largely dealt in, and close 45¼-¾, with a fair demand and supply. Wheal Setons close firm, 134-6.

From MESSRS. WATSON AND CUELL, 1, *St. Michael's Alley, Cornhill.*

During the past week, business has again been very active. East Caradon, after rising to 39½, have dropped to 38 38½, and a large business doing. East Carn Brea advanced to 13⅛ 13¼, but dropped to 13, sellers, immediately after the meeting yesterday. Tincrofts have been in a great demand, at 11½ to 12½. Devon Consols in great demand at 420, but no shares offering. Tolvadden, after reaching 4¾, dropped to 4⅛ 4⅜, at which price they close. Grylls firm, at 33. Rosewall Hill firm, at 3⅞, buyers. Wheal Seton continue in demand, at 133. North Downs leave off flat, at 3¾. Cook's Kitchen still inquired for. Great Fortune advanced on Monday to 27, but leave off flatter at 25, sellers. North Phœnix in demand, at 5. Sithney Carnmeal find buyers at 30/, after being flat at 10/, sellers. Grenvilles rather weaker. East Grenville firm, at 31. Redmoor in good demand. West Rose Down in demand, at 15—shares are very scarce. West Caradons have been freely offered at 31¼. Alfred Consols flat, at 5/, sellers. Altogether, a large business is doing, and the market likely to continue active.

Prices Current of Metals.

From Messrs. James and Shakspeare's, 10, Austin Friars, E.C.

			Per Ton.		
IRON	Bars	in Wales	£5 0 0	@	£5 5 0
	„	„ Liverpool	....		5 15 0
	„	„ London	6 0 0	„	6 5 0
	Nail Rods	„ Wales	5 12 6	„	5 15 0
	„	„ Liverpool	6 10 0	„	7 0 0
	„	„ London	7 5 0	„	7 15 0
	Hoops (Staffordsdire)	„ Liverpool	7 15 0	„	8 10 0
	„ „	„ London	8 5 0	„	8 15 0
	Sheets „	„ Liverpool	8 10 0	„	9 5 0
	„ „	„ London	9 0 0	„	9 15 0
	Bars „	„ Liverpool	7 0 0	„	8 0 0
	„ „	„ London	7 10 0	„	8 10 0
	Scotch Pig (No. 1. g.m.b.)	the Clyde	2 12 6	„	2 13 0
	Rails	in Wales	5 5 0	„	5 10 0
	Russian	C.C.N.D.	....		....
	Swedish—Hammered—large sizes		11 10 0	„	11 15 0
	„ „ Indian sizes		11 10 0	„	11 15 0
STEEL	Hammered—faggot		....		16 10 0
	„ in kegs ¼ and ⅜ in...		....		15 10 0
COPPER	Australian and other *fine* Foreign		....		95 0 0
	Foreign Slab, for Prod. 96 per Cent.		....		88 0 0
	English Tile and Tough		95 0 0	„	98 0 0
	„ Best selected		98 0 0	„	101 0 0
			Per lb.		
	„ Sheets, Sheathing and Rod		10¾*d.*	„	11*d.*
	„ Flat Bottoms		11¼*d.*	„	11½*d.*
YELLOW METAL	Sheets, Sheathing and Rod		8½*d.*	„	9*d.*
			Per Cwt.		
TIN English	Common Blocks and Ingots		....		114*s.*
	„ Bars (in barrels		....		115*s.*
	Refined		....		119*s.*
Foreign	Straits		....		113*s.*
	Banca		121*s.*		122*s.*
			Per Box.		
TIN PLATES at Liverpool 6*d.* Less	Charcoal IC		28*s.*	„	29*s.*
	„ IX		34*s.*	„	35*s.*
	Coke IC		22*s.*	„	23*s.*
	„ IX		28*s.*	„	29*s.*
			Per Ton.		
LEAD	Sheet		....		20 10 0
	Pig—W.B.		21 0 0	„	21 5 0
	„ Ordinary brands		19 15 0	„	20 0 0
	„ Foreign, soft		....		19 0 0
	Red		....		21 10 0
	Shot		....		22 10 0
	Dry White		....		27 0 0
SPELTER	(Cake)		18 5 0	„	18 10 0
ZINC	(Sheet)		23 10 0	„	24 0 0
			Per Bottle.		
QUICKSILVER	(in bottles containing 75lbs. each)		....		7 0 0
			Per Ton.		
REGULUS OF ANTIMONY	French Star		46 0 0	„	47 0 0

There has not been much doing in the Metal-market since Friday last.

IRON.—*Scotch Pig* is quiet but steady.

COPPER.—Demand slack, and *Foreign* offering in small quantities on somewhat easier terms. A few sales of *Burra* are reported at £94 10s. 0d. and £95, and a little Chili at £88.

TIN.—*English* was reduced on 21st instant 3s. per cwt. on all descriptions. This movement has caused *Straits* to recede to 113s., at which a fair business has been done.

LEAD.—Good brands of English *Pig* have been in request for immediate shipment at £19 10s. 0d. @£19 17s. 6d. and several hundred tons have been purchased, chiefly on American account.

SPELTER.—Not much doing, a few lots of special brands at Hull being reported at £18 6s. 0d., and £18 7s. 6d.

Copper Ores.

Sampled March 12, and sold at Tabb's Hotel, Redruth, March 27.

Mines	Tons	Purchasers.	Price.	Mines.	Tons.	Purchasers.	Price.
Great Wheal Busy	82	8	£3 1 6	East Crinnis & Sou. Par.	50	6	£4 0 0
	79	8, 10	2 1 6		45	14	1 17 6
	78	2	2 8 6	North Treakerby	98	14	3 16 6
	63	8	1 16 6		48	8	4 16 0
	59	10	2 7 6		47	14	2 3 6
	50	7	3 9 6		44	4	5 7 0
	47	10	4 1 0		23	4	11 3 0
	45	10	3 5 6	North Downs	70	6, 7	6 11 6
	41	2, 14	2 8 6		62	4	5 17 0
	28	7, 10	7 2 6		61	6	8 12 0
West Caradon	76	8	6 3 0		57	6, 8	6 9 0
	75	2, 7	5 4 6	Tywarnhaile	63	6	3 1 6
	73	2	12 9 6		48	6	2 7 6
	71	3, 10	4 15 6		44	7	3 1 6
	67	7	9 8 6		43	3	5 1 0
	61	2, 7	7 7 6		42	14	2 14 6
	52	2	8 11 6	Craddock Moor	62	7	6 14 6
	46	2	5 5 6		49	7	8 0 6
South Caradon	95	4	5 13 0		34	10	5 1 6
	82	6	9 3 6		20	6	3 11 0
	60	7	8 3 6	Wheal Polmear	64	9	3 13 0
	59	2, 6	15 0 6		51	6	4 1 0
	45	2, 6	17 1 0		25	3	8 17 6
	42	4	5 18 6	St. Day United	46	8	4 17 6
	38	14	2 0 6		42	4	2 15 6
	35	3	6 2 6		39	6, 7	2 7 6
Clifford Amalgamated	68	8	4 7 0	South Crinnis	51	5, 7	3 18 6
(United Mines)	65	3	4 8 0		44	9	4 4 6
	64	11	2 14 0	New Treleigh Consols	45	3, 7	4 1 6
	63	11	2 13 0		30	5, 7	3 19 6
	39	14	3 7 6	Wheal Moyle	55	2, 6, 14	0 2 6
	38	11	1 3 0		9	12	6 14 6
	37	8	1 12 6	Duchy and Peru	28	2, 6	2 11 0
	28	6	3 7 0		13	2, 6	1 16 0
Fowey Consols	80	2	7 4 6		10	2, 6	10 14 6
	75	2	5 5 0	Perran Mines	36	6	4 2 6
	73	2	6 16 6	Pedn-an-drea	20	10	3 4 6
	72	2, 6	6 6 6		5	3	5 12 0
East Crinnis & Sou. Par.	100	7	5 9 6	Burra Burra	25	6	4 10 6
	90	7	5 7 6	Trenouth's Ore	19	6	2 8 0

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.		Tons	Amount.
Great Wheal Busy	572	£1,670 14 6	Wheal Polmear	140	£662 0 6
West Caradon	521	3,878 17 6	St. Day United	127	433 8 6
South Caradon	456	3,973 10 0	South Crinnis	95	386 1 6
Clifford Amalgam	402	1,187 16 0	New Treleigh Con.	75	302 12 6
Fowey Consols	300	1,925 7 6	Wheal Moyle	64	67 8 0
East Crinnis	285	1,315 12 6	Duchy and Peru	51	202 1 0
North Treakerby	260	1,199 6 6	Perran Mines	36	148 10 0
North Downs	250	1,715 4 0	Pedn-an-drea	25	92 10 0
Tywarnhaile	240	774 12 6	Burra Burra	25	113 2 6
Carddock Moor	165	1,053 14 6	Trenouth's Ore	19	45 12 0

EACH COMPANY'S PURCHASE.

	Tons.	Amount.		Tons.	Amount.
1 Mines Royal	—	——	9 Bankart and Sons	108	£419 10
2 Vivian and Sons	697½	£4,886 16 4	10 Copper Miners' Co.	294	1,066 [illegible]
3 Freeman and Co.	231	1,228 12 0	11 Charles Lambert	165	320 [illegible]
4 Grenfell and Sons	308	1,756 14 0	12 Newton, Keates & Co.	9	60 10 [illegible]
5 Crown Copper Co.	40½	159 14 3	13 Alkali Co.	—	——
6 Sims, Willyams & Co.	697 5-6	4,081 7 10	14 Sweetland & Co.	347 5-6	936 [illegible]
7 Williams, Foster & Co.	721½	4,320 18 3			
8 Mason and Elkington	488	1,910 17 9	Total	4106	£21,148 [illegible]

Average Produce, 6[illegible]
Quantity of Fine Copper, 262 tons 6 cwt.

Average Standard .... £123 1[illegible]
Average Price per ton............ £5 [illegible]

Copper Ores.

Sampled March 19, and sold at Tyack's Hotel, Camborne, April 3.

Mines.	Tons.	Purchasers.	Price.
Clifford Amalgamated	110	5, 7	£6 3 6
(Wheal Clifford)	105	4	7 0 6
	101	14	4 1 0
	100	5, 7	6 6 6
	91	5, 7	5 17 6
	82	2, 3	4 16 6
	62	4	6 10 0
	61	8	5 7 0
	46	6	8 10 6
	45	8	4 8 0
	34	16	3 8 6
	30	2	4 5 0
(Consols)	63	2	5 17 6
West Seaton	76	4	7 14 0
	75	2, 3	7 14 0
	67	14	2 10 0
	59	4	6 7 0
	57	4	4 13 0
	56	10	5 1 6
	52	10	4 9 0
	51	5, 7	8 1 6
	38	3	6 14 6
Tincroft	108	9	0 10 6
	70	2	2 18 6
	65	8	4 19 6
	49	2, 7	4 13 6
	48	10	4 11 0
	40	11	2 18 0
	33	4	6 12 0
	19	14	1 14 6
East Pool	64	3	4 10 0
	61	11	3 15 6
	45	2, 6, 9	0 5 6
	41	8	4 12 6
	33	10	4 6 6
	32	11	2 13 6
	26	11	2 13 6
	18	11	1 9 0
Wheal Seton	27	8	4 3 6
(Pendarves)	83	10	1 1 6

Mines.	Tons.	Purchasers.	Price.
Whl. Seton (Pendarves)	62	2	£4 15 6
	44	2, 7	4 17 6
	43	2, 7	7 13 6
	30	2, 7, 8	14 0 6
	22	3	2 14 0
Wheal Basset	73	6	7 14 6
	61	7	5 14 6
	57	2, 9	4 18 6
	42	2, 7	7 16 6
	23	2	1 7 6
Condurrow	93	6	1 14 6
	78	5, 7	5 18 0
	74	11	2 4 0
	6	8	11 11 0
South Frances	59	2	4 19 0
	42	5, 7	6 14 6
	41	3	6 1 6
	39	7	5 4 6
	21	8	8 3 0
	5	7	4 15 0
South Tolgus	75	5, 7	4 6 0
	56	5, 7	8 14 6
Camborne Vean.........	62	8	5 1 0
	60	14	3 5 0
East Basset	57	2, 6	3 19 6
	45	9	3 14 0
	18	2, 6	6 13 0
Stray Park	53	5, 7	3 3 0
	21	5, 7	7 14 6
Dolcoath	48	14	3 19 6
South Crofty	22	8, 11	1 15 0
	21	7	7 4 6
West Tolgus	36	2	3 14 6
South Basset	30	8	2 6 0
Wheal Uny	19	8	3 8 6
	11	2	9 8 0
Carn Camborne	30	8, 14	2 16 6
West Condurrow	4	2	5 15 0
Halse's Ore	1	4	4 5 0

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.		Tons.	Amount.
Clifford Amalgam	930	£5,322 5 6	East Basset	120	£512 15 6
West Seton	531	3,152 17 6	Stray Park	74	329 3 6
Tincroft	432	1,398 17 6	Dolcoath	48	190 16 0
East Pool............................	320	1,044 5 0	South Crofty	43	190 4 6
Wheal Seton	311	1,522 13 6	West Tolgus	36	134 2 0
Wheal Basset	256	1,554 3 0	South Basset	30	69 0 0
Condurrow	251	852 14 6	Wheal Uny	30	168 9 6
South Frances......................	207	1,222 5 0	Carn Camborne...................	30	84 15 0
South Tolgus	131	811 2 0	West Condurrow	4	23 0 0
Camborne Vean..................	122	508 2 0	Halse's Ore	1	4 5 0

EACH COMPANY'S PURCHASE.

	Tons.	Amount.		Tons.	Amount.
1 Mines Royal................. ..	—	——	9 Bankart and Sons	196½	£367 13 9
2 Vivian and Sons......	616½	£3,078 3 6	10 Copper Miners' Co.	306	1,082 8 0
3 Freeman and Co.	243½	1,338 12 0	11 Charles Lambert	262	709 11 6
4 Grenfell and Sons	393	2,587 11 6	12 Newton, Keats & Co. ...	—	——
5 Crown Copper Co..........	338½	2,070 11 3	13 Alkali Co.	—	——
6 Sims, Willyams & Co. ...	274½	1,434 0 3	14 Sweetland and Co.	310	1,037 10 0
7 Williams, Foster & Co....	563½	3,490 8 3			
8 Mason and Elkington ...	403	1,899 6 6	Total	3907	£19,095 16 6

Average Produce, 6.
Quantity of Fine Copper, 234 tons 10 cwts.

Average Standard £127 5 0
Average price per ton 4 17 6

Copper Ores.

Sampled March 26, and sold at Tabb's Hotel, Redruth, April 10.

Mines.	Tons.	Purchasers.	Price.
West Basset	67	7	£5 13 0
	63	10	4 11 0
	60	8	13 11 0
	54	4, 8	4 10 0
	53	11	5 6 0
	52	11	4 6 6
	43	4	8 0 0
	30	6	10 17 6
	27	8	5 3 0
	22	8	6 9 0
Carn Brea	127	2	0 2 0
	67	7	6 19 0
	58	3	4 12 0
	41	2	3 16 6
	40	2	4 7 6
	38	8	2 17 6
	35	14	2 6 6
Par Consols	78	2, 3	10 13 6
	76	7	7 14 0
	70	4	6 12 6
	30	9	4 5 0
Great South Tolgus	60	10	6 11 0
	49	7	10 16 6
	47	10	7 8 6
	30	2, 3	9 17 6
Great Wheal Alfred	50	8	4 6 6
	44	8	2 12 0
	42	7	3 18 6
	39	11	2 11 0
Wheal Charlotte	61	7	7 18 0
	56	7	5 13 6
	25	6, 10, 11	2 4 6

Mines.	Tons.	Purchasers.
Prosper United	107	2
	23	2
Pendeen Consols	64	6
	32	6
	14	6
	8	2
West Alfred Consols	45	2
	27	8
	23	2
	12	11
	10	8
Rosewarne United	58	7
	40	4
	5	3
Copper Hill	59	4
	34	3, 6
	8	6
Treloweth	52	6
	26	2, 6
Wheal Buller	44	3
	29	3
Wheal Anna	41	2, 6
	22	10
Wheal Unity Consols	26	8
Rosewarne Consols	21	2, 8
	5	4
Boiling Well	25	2, 14
Gurlyn	25	2, 8
South Dolcoath	17	4, 8
Great Wheal Fortune	10	8
Camborne Consols	8	2, 4
North Great Work	4	14

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.
West Basset	471	£3,178 4 0
Carn Brea	406	1,267 12 0
Par Consols	254	2,009 2 0
Great South Tolgus	186	1,568 13 0
Great Wheal Alfred	175	594 19 0
Wheal Charlotte	142	855 6 6
Prosper United	130	813 4 6
Pendeen Consols	118	494 17 0
West Alfred Consols	117	208 19 0
Rosewarne United	103	825 0 0
Copper Hill	101	739 16 6

	Tons.
Treloweth	78
Wheal Buller	73
Wheal Anna	63
Wheal Unity	26
Rosewarne Consols	26
Boiling Well	25
Gurlyn	25
South Dolcoath	17
Great Wheal Fortune	10
Camborne Consols	8
North Great Work	4

EACH COMPANY'S PURCHASE.

		Tons.	Amount.
1	Mines Royal	—	——
2	Vivian and Sons	541	£2,431 7 6
3	Freeman and Co.	207	1,502 6 0
4	Grenfell and Sons	256½	1,615 7 0
5	Crown Copper Co	—	——
6	Sims, Willyams, & Co.	258 17½	1,627 2 7
7	Williams, Foster & Co.	476	3,497 2 6
8	Mason and Elkington	372½	2,253 8 0

		Tons.
9	Bankart and Sons	30
10	Cooper Miners' Co.	200½
11	Charles Lambert	164½
12	Newton, Keates & Co.	—
13	Alkali Co.	—
14	Sweetland and Co.	51½
	Total	2558

Average Produce, 7.
Quantity of Fine Copper, 179 tons 8 cwt.

Average standard ....
Average Price per ton ....

Copper Ores.

Sampled April 2, and sold at the Royal Hotel, Truro, April 17.

Mines.	Tons.	Purchasers.	Price. £	s.	d.
Devon Great Consols	134	6	£4	2	0
	133	6	4	16	0
	130	9	4	6	6
	122	10	4	13	6
	105	8	3	18	6
	101	11	3	16	6
	98	12	9	1	0
	96	11	3	15	0
	95	2, 11	2	15	0
	83	2, 3	10	3	6
	76	14	3	11	0
	74	2	8	3	0
	73	7	4	4	6
	71	2	4	3	6
	67	7	7	14	6
	66	2	4	3	0
	63	2	9	10	6
	62	6	2	15	0
	42	2, 3	11	6	6
East Caradon	107	14	6	4	0
	95	8	5	1	0
	86	14	5	0	0
	71	2, 6	9	3	6
	46	2, 6	6	8	0
	25	2, 6	14	7	0
Marke Valley	110	9	5	0	6
	100	5, 7	3	18	6
	75	2	4	13	0
	59	9	5	16	6
	56	2, 9	3	5	0
Phœnix Mines	85	14	2	17	6
	84	4	3	3	6
	71	4	3	19	6
	63	4	8	18	6
	57	4	3	15	0
Great Wheal Martha	100	2, 6	1	18	0
	70	2, 6	3	5	0
	69	2, 6	1	16	6
	60	2, 6	2	0	0
Great Wheal Martha	46	2, 6	£5	9	6
Crelake	118	8	3	5	6
	107	7	4	9	6
	44	10	6	17	6
	38	10	3	0	0
	33	8	3	3	0
Wheal Edward	102	3	2	1	0
	101	3	4	1	0
	40	14	3	12	6
	34	14	3	7	6
	25	3	10	18	0
North Wheal Robert	74	6	8	19	0
	66	10	1	9	6
	38	6	22	3	6
	36	10	4	6	6
Bedford United	112	5, 7	4	17	6
	98	5, 7	4	15	6
Wheal Emma	58	9	4	17	6
	46	5, 7	9	10	6
	37	2	2	1	6
Sortridge Consols	83	6, 8	8	9	0
	56	10	4	14	0
Wheal Arthur	82	8	2	15	0
	50	6, 8	3	46	6
Wheal Friendship	78	5, 7	7	17	6
	48	5, 7	10	9	6
Okel Tor	60	8, 11	2	5	0
	40	8, 11	2	14	6
Devon and Cornwall	69	8, 11	1	16	0
	26	6, 8	7	8	0
Molland	57	5, 7	5	0	6
Wheal Crebor	44	8, 10	3	19	6
Brookwood	42	3, 6	4	7	0
	2	2	20	15	6
Trehill	29	2, 6	1	18	6
Hawkmoor	27	5, 7	3	14	6
Redmoor	25	2, 6	4	2	6
Devon and Courtenay	22	6	2	4	0
Kitt Hill	15	2, 6	0	7	6

TOTAL PRODUCE AND VALUE.

	Tons.	Amount. £	s.	d.
Devon Great Con.	1691	£8,986	19	6
East Caradon	430	2,877	14	6
Marke Valley	400	1,819	18	6
Phœnix Mines	360	1,569	6	6
Great Wheal Martha	344	911	11	0
Crelake	340	1,385	14	6
Wheal Edward	302	1,150	8	0
North Wheal Robert	214	1,758	0	0
Bedford United	210	1,013	19	0
Wheal Emma	141	797	13	6
Sortridge Consols	138	956	2	0
Wheal Arthur	132	416	15	0
Wheal Friendship	126	£1,117	1	0
Okel Tor	100	244	0	0
Devon and Cornwall	95	316	12	0
Molland	57	286	8	6
Wheal Crebor	44	174	18	0
Brookwood	44	224	5	0
Trehill	29	55	16	6
Hawkmoor	27	100	11	6
Redmoor	25	103	2	6
Devon and Courtenay	22	48	8	0
Kitt Hill	15	5	12	6

EACH COMPANY'S PURCHASE.

	Tons.	Amount. £	s.	d.
1 Mines Royal Co.	—	—		
2 Vivian and Sons	803	£4,312	12	9
3 Freeman and Co.	311	1,642	1	9
4 Grenfell and Sons	275	1,324	19	0
5 Crown Copper Co.	283	1,674	6	6
6 Sims, Willyams & Co.	840	4,731	12	6
7 Williams, Foster & Co.	530	2,979	3	0
8 Mason and Elkington	618	2,417	12	0
9 Bankart and Sons	385	£1,832	8	6
10 Copper Miners' Co.	384	1,590	11	0
11 Charles Lambert	329	1,061	1	0
12 Newton, Keates & Co.	98	886	18	0
13 Alkali Co.	—	—		
14 Sweetland and Co.	428	1,867	6	6
Total	5286	£26,320	12	6

Average Produce, 6¼
Quantity of Fine Copper, 328 tons 10 cwt.

Average Standard £124 7 0
Average Price per ton 4 19 6

Copper Ores.

Sampled March 12, and sold at Swansea, April 1.

Mines.	Tons.	Produce.	Purchasers.	Price.
Cobre	92	11	16	£9 9 6
	86	11	1, 14	9 3 6
	82	11¼	1	9 2 6
	70	11	10	9 6 6
Knockmahon	102	5¾	10	4 8 0
	92	9½	6	8 14 0
	89	10¾	2, 7	9 8 0
Great Barrier	98	12¾	7	£11 0 0
Lochwinnoch	78	2¾	6	1 18 0
	7	3¾	16	3 0 6
	4	9¾	16	8 10 6
Springbok	55	27¼	5	25 1 0
	7	36¾	5	33 4 0

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.
Cobre	330	£3,061 15 0
Knockmahon	283	2,085 16 0
Great Barrier	98	1,078 0 0
Lochwinnoch	89	£203 9 6
Springbok	62	1,610 3 0

EACH COMPANY'S PURCHASE.

	Tons.	Amount.
1 Copper Miners' Co.	125	£1,142 15 6
2 Freeman & Co.	44½	418 6 0
3 Grenfell and Sons	—	—
4 Crown Copper Co.	—	—
5 Sims, Willyams & Co.	62	1,610 3 0
6 Vivian and Sons	170	948 12 0
7 Williams, Foster & Co.	142½	1,496 6 0
8 Mines Royal	—	—
9 British & Foreign Copper Co.	—	—
10 Mason and Elkington	172	£1,101 11 0
11 Bankart and Sons	—	—
12 Charles Lambert	—	—
13 Ravenhead Copper Co.	—	—
14 Sweetland, Tuttle & Co.	43	394 10 6
15 Bold Copper Co.	—	—
16 Jennings and Co.	103	926 19 6
Total	862	£8,039 3 6

Copper Ores.

Sampled March 26, and sold at Swansea, April 15.

Mines.	Tons.	Produce.	Purchasers.	Price.
Cobre	100	10¾	9	£8 14 0
	99	10½	1	8 14 0
	98	10½	11	8 14 6
	97	10¾	6	8 11 0
	96	10½	1	8 10 6
	83	10¾	9	8 11 6
	63	21¼	7	18 7 0
	62	20¾	2	18 3 0
	12	58¾	9	49 1 6
Cuba	100	13¾	7	11 0 6
	95	13	6	10 14 0
	90	13¾	6, 7	10 14 0
	80	13¾	3	11 1 0
(Precipitate)	7	66¼	16	57 2 6
	66	21¼	3	17 18 0
	64	21¾	6, 7	17 19 0
Cuba	62	21¾	6	£17 18 0
(Precipitate)	5	66½	9, 11	54 12 6
Berehaven	110	10½	10	9 7 6
	92	10½	11	9 5 6
	82	10½	1	9 4 6
	68	10½	3	9 7 0
	120	10¾	6, 7	9 4 0
	113	10¾	2, 6	9 6 0
Laxey	136	6¼	3	5 15 0
Knockmahon	95	11½	2, 7	10 6 6
Australian Reg.	11	50½	2	46 5 0
Holyford	4	9¼	7	8 6 0
Spanish	2	19¼	6	16 10 0
	1	24¼	6	21 0 0
	1	10½	6	9 0 6
Slag	1	4	1	2 0

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.
Cobre	710	£7,816 1 6
Cuba	569	8,079 0 0
Berehaven	575	5,420 8 0
Laxey	136	782 0 0
Knockmahon	95	980 17 6
Australian Regulus	11	£508 15 0
Holyford	4	33 4 0
Spanish	4	63 0 6
Slag	1	2 0

EACH COMPANY'S PURCHASE.

	Tons.	Amount.
1 Copper Miners' Co.	278	£2,438 3 6
2 Freeman and Co.	177	2,644 5 9
3 P. Grenfell and Sons	350	3,483 4 0
4 Crown Copper Co.	—	—
5 Sims, Willyams & Co.	—	—
6 Vivian and Sons	451½	5,146 7 0
7 Williams, Foster & Co.	351½	4,390 1 9
8 Mines Royal	—	—
9 British & For. Copper Co.	197½	2,307 3 9
10 Mason and Elkington	110	£1,031 5 0
11 Bankart and Sons	192½	1,844 1[illegible] 3
12 Charles Lambert	—	—
13 Ravenhead Copper Co.	—	—
14 Sweetland and Co.	—	—
15 Bold Copper Co.	—	—
16 Jennings and Co.	7	390 17 6
Total	2115	£23,896 6 6

Lead Ore Sales.

Dates.	Mines.	Tons.	Price per Ton. £	s.	d.	Purchasers.	Amount of Money. £	s.	d.
Mar. 21.	Dyliffe	70	12	3	6	A. Eyton	852	5	0
	Aberdovey	34	11	7	0	Newton, Keates & Co.	385	18	0
	Dyfngwm	20	11	10	0	ditto	230	0	0
	Laxey	100	17	3	0	Sims, Willyams & Co,	1715	0	0
" 26.	Wheal Mary Ann	62	25	3	6	T. Somers	2029	17	0
		40	11	14	6	Treffry's Trustees			
	East Jane	14	12	11	6	Sims, Willyams & Co.	176	1	0
" 27.	Westminster	50	11	8	6	Walker, Parker & Co.	571	5	0
	Mount Pleasant	35	11	12	0	A. Eyton	544	5	0
	"	10	13	16	6	Walker, Parker & Co.			
	Hendre Ucha	22	11	14	0	ditto	257	8	0
	Pant-y-Buarth	10	11	1	6	ditto	110	15	0
	Trelogan	5	11	8	6	A. Eyton	57	2	6
	Garreg	6	11	8	0	ditto	68	8	0
	Dyliffe	60	12	0	6	ditto	721	10	0
	Nant-y-Iago	14	10	10	6	Walker, Parker & Co.	147	7	0
	Roman Gravels	30	11	10	6	ditto	345	15	0
	Pool Park	15	12	3	6	ditto	182	12	6
	Lower Park	5	11	6	6	Newton, Keates & Co.	56	12	6
" 28.	Ex *St. Elmo* (at Liverp.)	50	10	12	6	Locke, Blackett & Co.	531	5	0
" 31.	East Logylas	70	11	17	0	Walker, Parker & Co.	829	10	0
	Glogfach	60	14	3	0	Sims, Willyams & Co.	849	0	0
	Cwymystwith	100	11	15	0	ditto	1175	0	0
	Goginan	37	15	5	0	ditto	675	9	0
	"	8	13	18	0	ditto			
April 1.	Dyfngwm	14½	11	10	6	Walker, Parker & Co.	334	4	6
	"	14½	11	10	6	A. Courage and Co.			
	Rhoswydol	10	11	5	0	A. Eyton	112	10	0
	Minera	110	11	16	6	Newton, Keates & Co.	7324	14	0
	"	105	11	16	6	Locke, Blackett & Co.			
	"	100	12	0	0	Newton, Keates & Co.			
	"	100	11	16	6	ditto			
	"	100	12	13	0	Jones, McNicoll & Co.			
	"	75	12	13	6	ditto			
	"	12	10	10	0	Locke, Blackett & Co.			
	"	4	13	8	6	Jones, McNicoll & Co.			
" 2.	Isle of Man Mining Co.	100	22	10	6	Treffry's Trustees	2252	10	0
" 4.	Dyliffe	30	12	2	6	Adam Eyton	363	15	0
" 5.	Llanfyrnach	30	11	15	0	Panther Co.	352	10	0
" 7.	Carmarthen United	26	12	0	6	Sims, Willyams & Co.	312	13	0
" 9.	North Minera	20	11	10	6	Cookson and Co.	230	10	0
" 10.	Talargoch (Maesyrerwddu)	66	12	7	6	Walker, Parker & Co.	1080	2	6
	" (Coetia Llys)	21½	12	5	0	ditto			
	Deep Level	12	11	5	6	ditto	135	1	6
	Brynford Hall	11½	11	7	6	ditto	130	16	3
	Herward United	9½	10	4	6	ditto	97	2	9
	Rhosesmor	120	12	2	6	Adam Eyton	1455	0	0
	Orsedd	15	11	16	6	Walker, Parker & Co.	177	7	6
	Parrys	30	11	18	6	ditto	354	15	0
	West Merilyn	4	12	0	6	ditto	48	2	0
	Kilmory	7	11	5	0	ditto	78	15	0
	North Henblas	5	10	10	0	ditto	52	10	0
	Dyliffe	66	11	11	0	ditto	762	6	0
	Llanerchyraur	45	12	10	0	Newton, Keates & Co.	562	10	0
	Llangynog	10	11	0	6	ditto	220	10	0
	"	10	11	0	6	Walker, Parker & Co.			
	Bryn Gwiog	36	11	13	6	ditto	420	6	0
	Long Rake	15	11	6	6	ditto	169	17	6
" 11.	Cargoll	100	12	7	6	R. Michell and Son	1287	10	0
" 14.	Dyliffe	40	11	11	0	Adam Eyton	815	16	0
	"	30½	11	12	0	A. Courage and Co.			
	Frongoch	170	11	0	6	Walker, Parker & Co.	1874	5	0
	East Darren	60	14	0	6	ditto	841	10	0
	Cwm Erfin	25	13	15	6	ditto	776	12	6
	"	30	14	7	6	ditto			
" 15.	Clara United	20	11	8	0	Sims, Willyams & Co.	228	0	0
" 19.	Chiverton	64	16	0	0	R. Michell and Son	1339	14	6
	"	36	8	16	6	ditto			

Black Tin Sales.

Date.	Mines.	Tons.	c.	q.	lbs.	Price per ton £	s.	d.	Purchasers.	Amount of Money £	s.	d.
Mar. 29.	St. Day United	15	13	0	18	55	0	0	Mellanear	1852	3	11
April 2.	,,	18	0	1	13	55	0	0	Trethellan			
Mar. 29.	Tincroft	20	7	0	7	63	15	0	Bolitho and Sons	1724	11	11
April 2.	,,	6	13	3	27	63	15	0	Bissoe Co.			
Mar. 29.	Drake Walls	8	0	0	0	70	0	0	R. Michell and Co.	1642	7	6
	,,	15	10	0	0	67	5	0	ditto			
April 5.	Gurlyn	6	3	0	25	64	15	0	Chyandour	398	11	6
,, 6.	Ashburton United	4	7	0	19	68	10	0	Bissoe Co.	884	19	8
	,,	4	6	2	19	68	1	6	Daubuz and Co.			
	,,	4	5	2	10	68	2	0	Calenick Co.			
,, 8.	Redmoor	3	0	0	0	64	7	6	Bissoe Co.	193	2	6
,, 11.	Gt. Wh. Vor	23	5	3	26	—			———	1590	3	2
,, 12.	Pedn-an-drea	11	9	1	4	—			Bissoe Co.	674	3	0
	South Carn Brea	5	8	0	21	62	7	6	Carvedras	664	6	2
	,,	5	5	3	15	61	15	0	Chyandour			
,, 15.	Kitty (St. Agnes)	8	16	0	22	60	7	6	Harvey and Co.	531	17	9
	Brea Consols	4	2	0	18	70	15	0	R. Michell and Co.	345	10	6
	,,	0	15	1	21	60	0	0	ditto			
	,,	0	4	0	9	42	0	0	ditto			
,, 17.	Wendron Cons.	21	6	0	25	—			Carvedras	1337	19	5
,, 19.	Penhalls	5	17	0	6	—			Enthoven and Son	360	7	5
	,,	0	1	1	0	—			Harvey and Co.			
	Wheal Union	1	14	3	0	65	0	0	Chyandour	146	5	0
	,,	0	10	0	11	66	0	0	ditto			
	Wheal Uny	6	5	0	6	62	0	0	ditto	387	13	0

Sundry Copper Ore Sales.

Date.	Mines.	Tons.	Price per ton £	s.	d.	Purchasers.	Amount of Money £	s.	d.
April 17.	Lot 1 Parys Mines	100	6	1	6	Newton, Keates & Co.	2816	[illegible]	0
	2 ,,	98	6	2	0	ditto			
	3 ,,	95	6	4	6	ditto			
	4 ,,	87	6	3	6	ditto			
	5 ,,	105	2	9	0	Charles Lambert			
	6 ,,	85	2	13	0	ditto			

Sold by Mr. Pitcairn Campbell.

Date.	Mines.	Tons.	c.	Price per ton £.	s.	d.	Purchasers.	Amount of Money £.	s.	d.
April 17.	Lot 1 ,,	7	0	19	17	6	Vivian and Sons	550	1[illegible]	1
	2 ,,	0	17	26	14	0	ditto			
	3 ,,	1	0	22	11	6	ditto			
	4 ,,	0	4	64	3	6	ditto			
	5 ,,	5	10	5	14	0	ditto			
	6 ,,	49	0	3	0	0	Charles Lambert			
	7 ,,	15	0	1	13	0	ditto			
	8 ,,	20	0	1	13	6	J. Keys and Son			
	9 ,,	11	0	10	16	6	Newton, Keates & Co.			

Date.	Mines.	Tons.	c.	q.	lbs.	Price per ton £	s.	d.	Purchasers.	Amount of Money £	s.	d.
Mar. 6.	Alderly Edge (precipitate)	17	0	3	0	54	12	3	Sims, Willyams & Co.	2729	[illegible]	[illegible]
,, 18.	,,	13	17	2	0	55	5	0	——			
Apr. 3.	,,	17	8	1	0	59	7	10	——			

THE

MINING AND SMELTING MAGAZINE.

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Gold Mining at Clogau, North Wales.

BY WARINGTON SMYTH, M.A., F.R.S., SEC.G.S.,
Chief Inspector of Crown Mines.

"Put forth thy hand, reach at the glorious gold!"
Pt. II, HENRY VI, Act 1.

THE bare existence of gold in various parts of our islands has been the subject of remark from the time of the invasion of the Romans. In most of the places which acquired a notoriety for its occurrence it was found only as spangles or dust in the alluvium of stream works,—as at Pentuan, &c., in Cornwall; Croghan Kinshela, in Ireland; Lead-hills, in Scotland. In a few instances it had graced part of a solid vein—as near South Molton: in others it was, in all likelihood, merely represented by those frequent deceivers of the ignorant, pyrites and mica.

But during the last twenty years, and this is going back some time before men's eyes were opened by the discoveries in California, a remarkable character has attached itself to a portion of North Wales as a gold-containing district; and even whilst it remained doubtful whether any commercial importance could be ascribed to its presence, the facts were not the less interesting to the mineralogist.

Who the Cadmus was that first, on the hills of Merionethshire, exclaimed with Shakespeare's Timon—

"What is here?
"Gold? yellow, glittering, precious gold?"

appears to be already uncertain,—precedence being claimed by several persons. But the first account in print was, I believe, the paper of Mr. Arthur Dean, communicated to the British Association in 1844, in which, not satisfied with stating the few meagre facts known at the time, the author generalized fearlessly, and evolved a complete net-work of lodes, as Germanic writers say, out of the depths of his internal consciousness.

Soon after this, in 1846, I had the opportunity of minutely examining some of the more notable lodes near Dolgelly, in the district which had most attracted attention. The Cwm-heisian mine, originally opened to work some lead veins, had just been sold as a "gold mine" for 14,000*l.*, neither buyer nor seller having made the slightest approximation to an estimate of the length, breadth, or depth of the auriferous ground, or of its fair average yield.* The assays and experiments made by Mr. Clement, who was called in to act as metallurgist, showed that the specimens contained a proportion of gold which would be considered highly profitable in the old gold mining districts of Salzburg, of Hungary, and of America. Great expense was incurred by Mr. Bruin, the new owner, not in working the ground, or in erecting apparatus under the advice of men who were practised in gold mining, but in following out the contrivances of ingenious schemers; and the result was a very early suspension of all operations.

The historical sketch of what has occurred since 1846, in connexion with the gold in the Dolgelly district, might be extended to great length, and not without profit to intending speculators; but I have only glanced at it for the purpose of showing the early date of the original discovery, and the unwise course of action of the adventurers, which has been repeated over and over again by others, down to the present moment. Let me only state, briefly, that after the astounding harvests of gold in California and Australia, and the stirring up of the Exhibition, in 1851, a quicker pulse began to beat in the veins of lessees and explorers and proprietors connected with North Wales, which in 1854 and 1855 broke into a violent yellow fever, and swept over the region between Cader Idris and Snowdon, a "rush" of sharebrokers, miners, tradesmen, swindlers, and inventors, who kept the country in a not unpleasant excitement for about a couple of years. The track of the inundation may still be traced by the curious in the shape of deserted water-wheels, cast-iron balls —massive beyond the dreams of Armstrong or of Whitworth,— unpaid inn bills, and ruinous buildings. Quicker than it arose, the whole affair collapsed; some might call it a bubble, but that I cannot do, seeing that during this time gold was discovered, generally visible too, in a number of different veins, and that the true value of it was never fairly tested. Many thousands of pounds were "expended." In what? Certainly not in miner's work, for there were only two or three instances in which the rock was attacked, but rather in surface erections,—in contrivances patented by people who had never seen a well-provided gold mine, and in transactions for the passage of money from one hand to another. And whilst several hundreds (perhaps one might say thousands) of pounds worth of gold were carried off as specimens, or ostensibly for assays and trials on the grand scale, respectable people in the very town of Dolgelly doubted the existence of the gold *in toto*,—and Her Majesty, the proprietress of the royal metal, was simply robbed of every tittle of her dues.

A period of bankruptcy and destruction of character followed, in

* The seller of the mine was the late Mr. James Harvey, who deserves to be mentioned as an enthusiastic amateur of mines, and especially as a firm believer in the ultimate success of gold mining around Dolgelly.

which poor Nature, in the name of the Welsh gold districts, suffered; for much of that obloquy which should have been entirely kept for the scheming intruders in the land of the Cymry was allowed to attach to the innocent district.

During the last two years and a-half a fresh series of events has occurred, consisting mainly of the farther discovery and successful treatment of auriferous vein-stuff at Clogau. The excitement on the subject, long repressed by the recollection of former mishaps, is now culminating. If certain people are not more honest than they or their precursors were eight years ago, it is time, at least, that others should be more prudent.

Many of my readers are, doubtless, acquainted with the road from Dolgelly to Barmouth—one of the most beautiful scenes in Great Britain. Half-way between the two places, an impetuous stream, descending from the high range of Llawllech, pours its waters over a rocky bed to join the Mawddach, below Pontddu. On either side of this bright and leaping river there rises a mountain, in which copper veins have, for many years, been worked on the west, the Vigra, and on the right the Clogau. The minerals on both sides belong to the Crown, but had been leased some years ago; and soon after the period of monetary break down, to which I have above referred, it was very difficult, what with mortgages, and bankruptcies, and sales, to comprehend who were the responsible parties. A vein in which gold had been found in 1854 was left untouched, but workings were carried on in the copper lodes after a fashion so barbarous as to excite the astonishment of every miner who inspected them; and as might be expected, neither profit nor proof of the farther existence of ore followed.

By the end of 1859 the ownership of the mine was brought into clearer light; a limited liability company was formed, and a couple of men were set to drive on the gold vein, named St. David's lode, which, in the "end" at that time, offered no appearance of gold, the level having passed through that part which had yielded gold before, and got into dead ground.

This lode lies about a quarter of a mile further north than the Clogau copper lode, coursing in the same manner about E.N.E. by N., and intersecting dark schistose rocks of the lower silurian formation, with which are associated both interstratified and intrusive or dike-formed greenstones. On the north, at the distance of a few hundred feet, the massive greenish grits of the Cambrian system pass out from under the highly inclined beds of the lower silurian or lingula flags, but from the intense cleavage of the masses it is often difficult to recognise this arrangement of the strata.

The vein itself, where well-developed, is from 2½ to 9 ft. in width, between distinct walls, especially on the south, underlying commonly to the north, but on the whole nearly perpendicular. It is composed of quartz and calcareous spar, the latter sometimes forming a body of several feet in width; and when the calcite puts on the appearance of a finely granular and friable marble, it frequently contains gold; when, on the contrary, it is large and coarsely foliated, it appears to be entirely wanting in the precious metal. Spots of iron and copper pyrites are not unfrequent, and hence the lode was originally opened

upon for copper; fragments of the more or less talcose schist of the walls are occasionally included; and sometimes in one part, sometimes in another, the delicate pale yellow points and spangles of gold may be seen disseminated in the calc spar or quartz, often accompanied by bright white crystalline scales of the mineral of tellurium, sulphur, and bismuth, called tetradymite.* The laminæ of division of the rocks which form the country on either side of the lode strike a few degrees more north of east, so that they are intersected somewhat obliquely by the walls, and it requires watchfulness on the part of the manager to prevent, when the vein is obscure, the men's turning the level off from the lode.

Another noticeable feature is the frequent occurrence of planes of division nearly horizontal, crossing the lode from one wall to the other. These, in some veins, we may see to be filled with zinc blende or calc spar, as some of the newer formed minerals, but at Clogau I have been unable to observe that the gold has any connexion at all with these comparatively late fissures.

I wish I could add that the above-mentioned limits give the constant breadth of the lode; but, constant to the habits of the repositories of the precious metal, St. David's exhibits a capricious variation within short distances in excess of the well-known variability of other metalliferous veins. There are places, in fact, where a mere thread of spar, or even a slight division only, very easily overlooked, constitutes the only vestige of what, a fathom or two back, was a body of 9 feet wide. Let no one, therefore, think to obtain success, or even to make an estimate of the value of a sett, by pricking a few feet here and there, according to the method which has been so commonly adopted in Welsh explorations. Nothing but a steady and systematic opening of ground by driving and sinking can give any idea of the worth of a gold vein: one portion, where the gold is visible, will be exceedingly rich; another, where, perhaps, it can no longer be seen, will pay; another will not contain a trace; and further, perhaps, the lode itself is for some distance entirely nipped to nothing. I must, however, do justice to a good local miner in John Parry, who for many years has managed the mine, and to whom is mainly due the successful treatment of the ore, by remarking that little as his successive principals seem to have understood some of the plainest principles of mining, he has always felt the hardship of being ordered to rob his copper lodes like a caffre, or to stay his hand when he ought to be opening ground.

The level, or adit, driven on St. David's lode, is very near the top of the moutain, and penetrates now nearly fifty fathoms, at a moderate depth, beneath the showy and instructive out-going or crop of the lode, projecting several feet above the grass-covered knoll. A little further east than the shallow adit has reached, the lode turns off a

* The mineral occurs in thin crystalline plates and scales of brilliant metallic lustre and silver whiteness. Hardness, 1·5 to 2. In the matrass it gives a grey sublimate; in the glass tube, a whitish one; on charcoal, a yellowish incrustation, with white border, which an application of the reducing flame chases away with a blueish flame. Melts easily into a bright metallic bead, which in cooling coats over dark, and which is very brittle. I have observed no smell of selenium with it, which is usually noticeable in the Hungarian tetradymite.

little abruptly a few points further north, and a dike of greenstone crossing obliquely seems to give rise to some confusion before we arrive at the boundary of the estate of Garth Gell.

Some six and twenty years ago, when this lode was expected to turn out a copper mine, a cross-cut was put into the lode from the north, 12½ fathoms deep, which, on cutting a great coarse lode, 8 or 9 feet big, of white quartz, with spots of calc spar, was given up in despair. This has now furnished a second point of attack, and a winze has been put through between the two levels, and the chief result is, that although a rich bunch has not yet been cut below, gold has been proved to exist all through.*

In 1860, it became evident that the chiefly important part of the vein was the comparatively small bulk of it which contained visible gold; hence arises a great convenience, both in breaking it securely underground and in manipulating it at the surface. The apparatus at command of John Parry were a "Britten's" machine and a big "Berdan," obtained in the earlier years of goldy expectations. The former is a large mortar, with a somewhat conical pestle worked round and round against the cast-iron sides of the mortar by machinery; the second is the gigantic basin and balls, whose introduction by an astute Yankee is yet felt by the pocket of many a duped Britisher. But the quantities to be dealt with being moderate, the question of more efficient machines for stamping or grinding was postponed, and trials were made principally with the smaller, in suitably triturating and amalgamating at the same time; and when it was proved that blocks of 150 lbs. weight would yield 8 or 10 ozs. of gold, and that two men stoping the vein could more than keep the machine going, the day of the doubters seemed to be closing in. It has proved, that when the tetradymite is present (as it often is with some of the best parts of the lode) it is desirable to calcine the stone before attempting to amalgamate; the remainder, however, is only spalled down to a convenient size, and fed at once raw into the machines. The frequency of addition of water and of "stuff" to the mercury in the basins, as well as the time for clearing out, varies according to the circumstances, which Parry appears now to have mastered. Slowly and steadily, and with never more than four men stoping in the vein (four others driving in the end) the quantity of gold returned has been increased; and in face of the somewhat faint praise, and wishy-washy admissions of value, which have appeared in certain papers on the subject of this, our first successful British gold mine, the following figures show, not only the telling amount realized by the continuous working, but also the large proportion of it which is obtained by the use of a small and inexpensive apparatus.

* Whilst these pages were in the press, a discovery of good visible gold in the deep level was announced.

RESULTS OF WORKING FOR THE YEAR 1861.

	Quantity.			Yield of Gold.		
	Tons.	cwts.	lbs.	ozs.	dwts.	grs
Ground in Britten's machine—						
11th January to 5th October	3	15	9	1,242	16	0
5th October to 3rd January, 1862 ..	2	7	23	1,060	15	0
	6	2	32	2,303	11	0
In Berdan's machine—						
11th January to 5th October	263	19	0	273	1	0
5th October to 3rd January, 1862 ..	185	19	0	207	9	7
	449	18	0	580	10	7
Total for both machines ..	456	0	32	2,884	1	7

If we go over a part of the same time again, and look at the results of the last financial half-year, we have—

	Quantity.				Yielding Gold.		
	Tons	cwts.	qrs.	lbs.	ozs.	dwts.	grs.
Ground in Britten's machine—							
5th October to 5th January	2	7	0	23	1,060	15	0
5th January to 28th March	3	6	1	14*	1,194	10	0
28th March to 4th April	0	6	1	6	126	17	0
Total for half-year	5	19	3	15	2,382	2	0
In Berdan's machine—							
5th October to 5th January	185	19	0	0	207	9	7
5th January to 28th March	189	14	0	0	198	10	0
28th March to 4th April (lower adit)	10	16	0	0	7	9	0
Total for half-year	386	9	0	0	413	8	7
Total, both machines in half-year	392	8	3	15	2,795	10	7

These figures speak distinctly for themselves; and if any one in the least degree conversant with miners' work will compare this yield with the costs of four men driving and four stoping, he will see that there are few, if any, adventures in the world that can compete with this on its present scale?

But how long will it last? How far in length will it hold, and how far in depth? He would be an impudent guesser who would venture any estimate in the present unproved state of the district. The richest gold region in Europe is that of Verespatak, in Transylvania: very numerous veins are worked there in rocks, which if not eocene are not older than the chalk,—rocks equivalent, probably, to the Vienna sandstone. It was always feared that these veins would

* This includes the re-working of the "tailings" of the preceding ore, which gave 13 ozs. 7 dwts.

fail in depth; some have done so, but others have cut rich in a deep adit, brought in many fathoms below the old workings, which themselves extend through hills of several hundred feet in height. To the Californian and Australian our Welsh lodes have very little resemblance; they are far more like those of Virginia and Carolina, which have been made the subjects of too much sharp practice to supply us with trustworthy details. Meanwhile, we can only recommend the company to push their exploratory works, which, as the ground is on the average worth 6*l.* to 8*l.* per fathom to break, and then requires no timber, may be carried out a moderate rate.

A second question that suggests itself is, whether the best apparatus is employed for extracting the gold. If large quantities had to be dealt with I should say certainly not, for then a well-constructed stamps, like those of Schemnitz or of Brazil would be indispensable for economical treatment. We know that, by their aid and the rest of the apparatus which is added to them, the Austrian mining managers extract, with advantage, one-eighth of an ounce per ton, and the St. John del Rey makes a noble profit with a quarter of an ounce per ton. Such results would leave a large margin, we believe, to a sufficiently skilled and practical person to work within, who could only make sure, in North Wales, of a sufficient body of tolerably auriferous veinstone to render such apparatus desirable. At Clogau, the apparatus hitherto used, grinding say from 500 to 800 tons a-year, has but a trifling task compared with that of a good range of stamps which will pound you up 20,000 to 30,000 tons in the same time. With a few improvements in the catching of the tailings all seems to work well there for these moderate quantities.

And a last question, also, will suggest itself to many. Is this Clogau the only good thing of the sort? or are we to believe, as some persuasive people wished us to do a few years ago, that every vein and wild-spar course throughout all these older rocks of Wales is capable of forming a prosperous gold mine? Either position is unlikely and untenable. A *single* unaccompanied good lode of any kind in a district is a very uncommon phenomenon; and if any observant man, with an eye for mineral character, compares with auriferous stones which he may have seen, the vein stuff of the blendy Cae Gwernog, of that grand champion lode Berthllwyd, and of the delicate-tinted Dolfrwynogs, he cannot but see that Nature has impressed them with a certain and a very suggestive character. The places mentioned have, it is true, already yielded specimens of gold, and so have a host of other localities in the same neighbourhood; the veins at the Prince of Wales, West Prince of Wales, the Cambrian mine, West Vigra, &c. Most of these lodes have a strong family likeness. Nearly all of them contain a sufficient quantity of finely granular bright galena, or of copper pyrites, to slock the adventurer to the place; but the mining that has been done, with the creditable exception of the Prince of Wales, has been either *nil*, or a mere trifle, or unsystematic and ill-regulated. And yet it is only by a reasonable quantity of steady working that their value for gold can be judged. Capitals of fifty or eighty thousand pounds may be got up for these purposes, or others, but appear to me thoroughly

unnecessary; for the mining is unattended by the heavy costs of engines, &c., needed in most districts for keeping water, and a judicious miner would, I think, in most of these setts, be able before long to conclude how many fathoms of ground he would have to open before he could pronounce on the value of its lodes for gold.

The Cornish Man-Engine.

The appointment of a royal commission to inquire into the condition of the metallic mines of the kingdom has naturally drawn attention to the various appliances by which the labour of climbing ladders may be avoided. It is pretty well agreed that, in the present state of engineering science, some mechanical means ought to be adopted for raising the miners from deep metallic mines; but opinions differ widely as to what those means should be. In Cornwall there is a large party who object to the use of the skip, or any other similar appliance, in the raising of men, principally on the ground of its being dangerous, and who believe that the man-engine is the only machine properly applicable in the varyingly inclined shafts of metallic mines; but there is also an influential party in the county who take a different view, and maintain that with proper care men could be raised with perfect safety in the ordinary skips. As the subject is evidently one of considerable importance, and as an accurate knowledge of the conditions connected with the installation of the man-engine is necessary in order to be in a position to understand the merits of the discussion, we give the following descriptions, most of which are founded on M. Moissenet's memoir in the *Annales des Mines* (5th Series, vol. xv, p. 1), with all additional information as to what has been done up to the present time.

While in collieries, from the earliest times, the workmen have been drawn up by the same means as those used for extracting the coal, this does not seem to have been the case in any metallic mining district in the United Kingdom, or on the continent; in Cornwall, in the Hartz, and in the Erzgebirge, the miners still continue to climb up by ladders. The most obvious cause of this difference is, of course, in the fact that while in collieries shafts are generally vertical, in metallic mines they are commonly inclined at various and frequently changing angles. The original notion of the present form of man-engine was conceived in 1833 by Her Dörell, then at Zellerfeld; and the first engine was placed, in the same year, in the Spiegelthal shaft, 110 fathoms deep. The principle on which the engine was constructed was very simple: it consisted of two rods, to which an alternative reciprocal motion was given, furnished with platforms, from which the miner passed alternately in his ascent or descent. This machine, which received the name of *Fahrkunst*, and was described in Karsten's *Archiv*, vol. x, was found so successful here, that another on a similar principle was put up in 1835 at the Georges Wilhelm mine, on a shaft 225 fathoms deep, underlying

2 feet in a fathom: these were followed by numerous others in various German and continental mines. In the cases mentioned, and indeed in almost every other case, the rods were of wood, like pump rods; but in 1836, when it was proposed to put analogous machines on still deeper shafts, like the *Schreiberfeder Schacht* and the Samson shaft of Andreasberg, it was feared that such rods would be too heavy, and it was resolved in consequence to replace them by wire rope. An arrangement of this kind was placed in the Samson shaft, which, in November, 1841, had attained the depth of 420 fathoms, and which it was expected would have to be sunk to the depth of 480 fathoms. This shaft was sunk on the course of the lode, and from surface to 210 fathoms had an underlie of 6 inches in a fathom; from the 210 to the depth of 300 fathoms it was vertical; below the 300 it took again an underlie of 6 inches in the fathom, but in an opposite direction, to the depth of 330 fathoms, below which it went down again vertical.

The first movement made to introduce these machines into Cornish mines was made in 1834 by Mr. Charles Fox, who offered considerable pecuniary prizes, first to the engineer who designed the best engine, and next to the mine which should erect it. Mr. Michael Loam gained the prize for the best design; and the adventurers of Tresavean mine were induced to erect one, being subsidized by a considerable subscription. This first engine, which went to work in January, 1842, and only extended at first to the depth of 25 fathoms, consisted of two rods (worked by a water-wheel) moving alternately with a 6-ft. stroke, the platforms on each rod being 12 feet apart.

This experiment was so far successful that it was determined, on the advice of Mr. Loam, to apply steam-power, and to extend the machine to the bottom of the mine. For this purpose a 36-in. cylinder engine, with a 6-ft. stroke, was erected—the stroke of the rods being extended to 12 feet, while the platforms remained the same distance apart. Thus modified, the engine was put to work to the depth of 140 fathoms on the 25th October, 1842, and finished to the depth of 290 fathoms in June, 1843; the mine being at that time 310 fathoms deep. A second engine, on the same principle, was put in at the United mines in 1845 by Messrs. Hocking and Loam; it extended to the depth of 210 fathoms, and is still working. Tresavean mine having been abandoned for some years, of course the original engine put up at that mine no longer exists.

The principle of those engines was that of the original *Fahrkunst*—that is, two rods oscillating reciprocally. In 1851, however, the late Captain Puckey, in connection with Mr. West, engineer, of St. Blazey, conceived and adopted a new system at Fowey Consols mine. This consisted in the substitution of a single rod for the double rods—this rod being furnished with platforms 12 feet apart, while a series of sollars, a similar distance apart, were placed in the shaft, on each side of the rod, in such a position as to correspond with the levels of the platforms at the end of each stroke. In this modification of the engine the miner, on leaving the platforms at the end of the up or down stroke, waits on the sollar until the next up or down platform comes to him. This type of man-engine, as we shall point out further on, is a decided improvement on the old

double-rod type, and engines on this plan have since been put up at Levant, Dolcoath, Cook's Kitchen, Carn Brea, Par Consols, and Wheal Reeth. Consequently there are at present eight man-engines working in the county—one double-rod at the United mines, and seven single rods at the mines named. Tabulating the leading particulars of these engines, we have the following statement, which shows the depth to which each engine extends, the particulars of the motive power working it, the relative number of strokes made by the motive-engine for one of the man-engine rods, the rate at which the rods themselves are made to move, the duration of the journey, and the velocity of the miner. In every case the length of the stroke of the man-engine rods is the same—12 feet.

Mines.	Depth of Engine.	Particulars of Motive-engine.			Relative No. of Strokes.	Rate of Man-engine.		
		Size of Piston.	Length of Stroke.	No. of Strokes.		No. of Strokes.	Journey.	Velocity.
	fathoms.	in.	ft. in.	per min.		per min.	min.	per min.
1. UNITED MINES .. (double rods)	210	32	6 0	18	6	3	17½	72ft.
2. LEVANT .. .. (single rod)	200	20	3 8	40	10	4	25	48
3. DOLCOATH ..	220	20½	5 0	42	12	3½	30	42
4. CARN BREA ..	132	26	6 0	16	4	4	16	48
5. PAR CONSOLS ..	220	24	6 0	25–30	5	5–6	20	68
6. WHEAL REETH ..	188	30	9 0	5–6	1	5–6	16½	68
7. FOWEY CONSOLS	280	Water-wheel, 30 ft. by 6 ft.				5–6	25	68
8. COOK'S KITCHEN	190	,,		52 ,,	3	3½	27	42

At the United mines and Fowey Consols the shafts are perpendicular the whole way. At Levant, after underlying slightly east, the shaft changes to a considerable west underlie in depth. At Dolcoath, the first 50 fathoms are perpendicular, but afterwards the underlie is south, 18 inches to 2 feet per fathom. At Carn Brea the shaft is nearly perpendicular to the 80, below which it underlies 1 foot in a fathom south. At Cook's Kitchen the shaft is perpendicular to the 60, and below that underlies 2 feet per fathom south.

Excluding the cases stated of Fowey Consols and Cook's Kitchen, the motive-engines are the ordinary Cornish rotary steam-whims double-acting, with vertical cylinder and beam, except in the instance of Wheal Reeth, where an ordinary pumping engine is used, and the rod is attached directly to the beam. Where a rotary engine is used, the rod is attached to the steam-engine by means of an ordinary balance bob, in the same manner as pump rods would be attached—a line of flat rods of greater or less length being used for forming the connection between them. In the cases of the United mines, Fowey Consols, Carn Brea, Cook's Kitchen, and Par Consols, the flat rods receive their motion from crown-wheels working in a vertical plane; in Levant and Dolcoath, from wheels working in a horizontal plane. This difference of arrangement has arisen from the nature of the motive engines to which the man-engine rods had

to be connected. That at the United mines was used to work a crusher, and consequently the wheels were most conveniently placed vertically. Those at Levant and Dolcoath, on the contrary, having been employed to work the old-fashioned vertical-axe whim, it was necessary to accommodate the movement to them, and consequently Mr. Hocking was driven to adopt the horizontal crown-wheels. The vertical ones are, however, much preferable, and being adapted to the modern form of drawing machine now in use, may be considered as the type to be adopted in future. The mode of connection is very simple: it consists of a crown and pinion-wheel, the latter (say 2 feet in diameter) attached to the axle of the motive power, and the former (say 14 feet), in which this works, to the periphery of which the rod connected with the bob is attached. The dimensions given are those of the cogwheels at the United mines, but, of course, the relative sizes of these will vary according to the relative number of strokes required to be made by the motive-engine to each stroke of the man-engine rods. These wheels are thrown in and out of gear in the ordinary manner, by which the man-engine is connected or disconnected from the motive-engine. In the case of the water-wheel at Fowey Consols, it was considered that its mass alone was insufficient to secure the proper regularity of the motion, and consequently a fly-wheel, weighing fourteen tons, has been added, worked by cogs at three times the rate of the water-wheel.

When the man-engine receives its motion from a vertical wheel, there is no difficulty in making the connection between it and the bob of the man-engine rods, inasmuch as they both work in the same plane. But when the motion is given by a horizontal wheel, as at Dolcoath and Levant, the connection is attended with some little difficulty, in order to bring within as narrow limits as possible the line of lateral variation of the connecting rods. At Dolcoath this is effected in the following manner:—The total distance between the horizontal crown-wheel and the shaft is about 27 fathoms. Between this there is first, an 8-inch rod, 24 feet long, attached at one end to the wheel, and at the other to another rod, at right angles, 22 feet long, working like a fend-off bob. To the point of junction of these two rods is connected the line of rods (7½ inches square) attached to the bob of the man-engine. The effect of this arrangement is, that the lateral variation, which at the head of the first piece of rod is 12 feet (the diameter of the wheel), is reduced by the action of the other rod at right angles to a variation of only one foot, which is not material.

The rods of the man-engines, like those of pumps, are of Norway pine, of the best quality, with an average length of about 36 feet. The size in the rods of the various engines varies as follows:—

Fowey Consols, Levant and Carn Brea..	8 inches through their entire length.
Cook's Kitchen and Par Consols.. ..	Succession of 8 inches and 7 inches.
Dolcoath	Succession of 8 inches, 7 inches, and 6½-inches.
United mines	7½ inches first 60 fathoms.
"	7 inches the 100 following fathoms.
"	6½ inches the last 50 fathoms.

They are joined together like the pump rods, that is, by four

wrought-iron strapping plates, generally about 1 inch thick, 5 inches wide, and from 10 to 12 feet long; these are screwed two and two together with 1¼ inch bolts 18 inches apart, so that each rod is held by eight bolts.

The platforms are of good deal, or oak, which is better, 1½ inch thick, but of varying size. In the double-rod engine of the United mines the platforms are 18 inches wide by 15 inches deep, with a space of 6 inches between them. In the single-rod engines at Dolcoath and Fowey they are respectively 16 inches and 12 inches square. This seemingly unimportant matter being really one involving to some extent the question of safety, I shall dwell upon it for a moment.

The only danger connected with the man-engine arises from the possibility of slipping the foot, or from carelessness in exposing the head or shoulders beyond the proper limits, and thus subjecting them to collision with the platforms, sollars, or walls of the shaft. Now there is less danger of slipping in stepping on a 12-inch platform than on a larger one; and besides, the more restricted the space, provided it is sufficient for the two feet, the more the miner will be obliged to hold himself upright on the platform, and thus avoid the risk of exposing his head or shoulders to collision with the sollars (in the case of the single-rod engine). The proper space between the two sollars generally would be from 22 to 24 inches. Now with a 12-inch platform there would be on each side a free space of from 5 to 6 inches, while with a 16-inch platform this is reduced to 3 or 4 inches, and consequently the possibility of collision, in case of carelessness, proportionately increased; consequently, a 12-inch platform seems the safest size.

These platforms (which it need scarcely be said should always be horizontal, whatever the underlie of the rod) are fixed in the rod by iron brackets. At Dolcoath this is done by bar-iron, 2 inches by ½ inch, and at Fowey Consols by angle iron. In every engine, a handle of ¾-inch round iron commences 4 feet above each platform, and extends up 2 feet long.

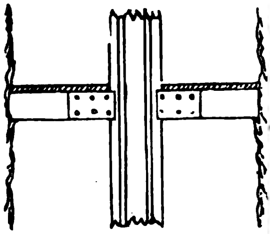
The drawing (fig. 1) on the opposite page, giving a front and side elevation of the single-rod type of man-engine, shows its general arrangement, and the manner in which the men step in and out at the end of each stroke.

Besides these more general particulars, there are a few special details of such practical importance as to make it advisable to give a few particulars concerning them. These are—the guides, sheaves, angle or V bobs for breaking the underlie, catch-pieces, and balance bobs. All these follow, more or less closely, the similar arrangements employed in pit-work.

Fig. 1.

Guides.—The drawings in figs. 2, 3, 4, 5, and 6, show the two arrangements of guides employed at Fowey Consols. One consists of a short bar fixed transversely at the back of the rod, the ends of which work in two longitudinal guides forming a groove; this arrangement is shown in figs 4, 5, and 6, of which fig. 4 is a front elevation, fig. 5 a ground plan, and fig. 6 a side elevation. The

Fig. 2.



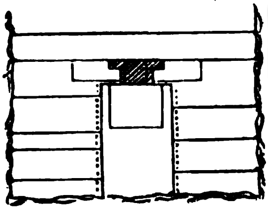
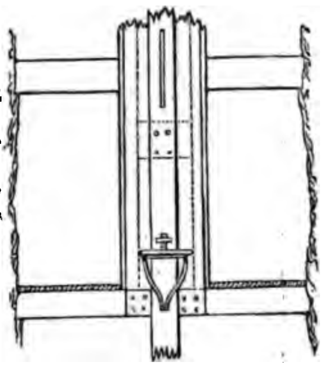


Fig. 3.

Fig. 4.



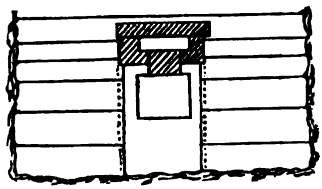
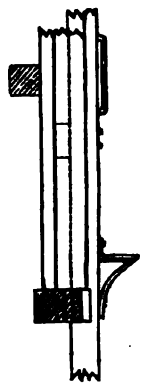


Fig. 5.

Fig. 6.



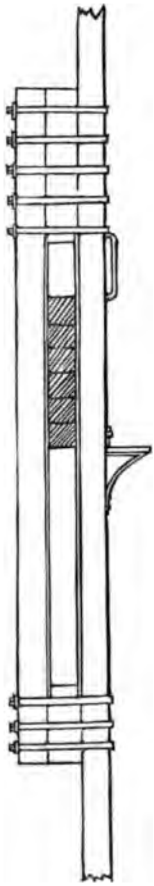
other arrangement, on the contrary, has a short groove in which two long pieces work, which are attached laterally to each side of the rod; figs. 2 and 3 will make this plain. In all cases the rods are protected by linings of beech or elm, and the guides are firmly secured by pieces of substantial timber fixed in the shaft. At Dolcoath for the perpendicular, or only slightly inclined portions, a strong plate is fastened at the back of the rod; this works on a fixed horizontal beam, in which two cramp-irons are placed, which extend over the projecting edges of the plate, and thus form grooves.

Sheaves.—The sheaves are of cast-iron, and are always placed behind the rod in the shafts, firmly secured to pieces fixed in the shaft. Their diameter should not, if possible, be less than 2 feet; at Dolcoath, according to the space disposable, they range from 2 feet 6 inches to 18 inches; the rims should not be less than 8 inches deep. The rod is secured against any vibrations which might cause it to get out of the sheaves by the guides or catch-pieces. A plank of beech, 18 inches thick, used as a lining to preserve the rod from the effects of friction, is fixed by staples on that face of the

rod working on the sheaves. These various guides, including the catch-pieces, should not be at less intervals apart than 10 fathoms.

Angle-bobs.—The most simple angle-bob for breaking the incline is that called the V bob, which is an isosceles triangle, the angle at whose summit is the supplement of the obtuse angle comprised between the two inclinations. These bobs, being those usually used for breaking the angle of pump rods, are sufficiently well understood; it is evident that the points of each of the arms of the V bob describes an arc of a circle whose radius is equal to the length of the side of the V bob, and that upon the length of this radius depends the amount of the deviation. As in the case of man-engine rods, the chord of the arc (the length of the stroke) is always 12 feet, with a 24-ft. bob the deviation will be 9·216 inches.

Fig. 7.



The fixing of a bob of this kind always requires the cutting of a large plat, and has besides, in the case of the man-engine, certain peculiar inconveniences. For instance, in this case it is not possible, as with pit-work, to keep the rod in place between two opposite sheaves, and the deviation causes a vibration which extends for a considerable length; besides, except in the rare case where the change of underlie is but a simple return towards the vertical, the V bob, occupying an obtuse angle, requires a change of the platforms to what was before the back of the rod. These inconveniences have been avoided at Dolcoath by means of a travelling bob with four wheels, the upper pair of which work in vertical guides, and the lower pair in inclined guides. The distance between the angles should be about 18 feet, and represent the length of a right line whose extremities receive a movement of 12 feet, following the sides of the obtuse angle. On the travelling-bob, between the axles, a platform is fixed—the two neighbouring platforms, above and below, being on the main rod.

In certain parts of Dolcoath shaft, where the inclination augments gradually without any sudden angle, the rod coming too close to the hanging wall of the lode, it suffices to keep it sufficiently off, to attach the next piece of rod not to the end of the last piece but behind it, putting a short piece between, and strapping and bolting the whole together.

Catch-pieces.—The accompanying sketch (fig. 7) shows the catch-pieces in use at Fowey Consols, which it will be seen do not differ materially from those used in pump rods, the object being to prevent, in case of breakage, a greater fall than 12 feet, the length of the stroke. These catch-pieces are placed at intervals of 40 fathoms apart, and in the Fowey Consols shaft are composed of six

pieces, each 8 inches square, forming a support 4 feet deep. Behind the catch-pieces another longitudinal retaining piece, 18 feet long, and also 8 inches square, is securely strapped and bolted by iron strapping-plates 2 inches by 1 inch at the top and bottom to the main rod, leaving an intervening space of 12 feet long by 11 inches wide, which is kept by the short intervening pieces, the upper one of which is 4 feet long, and the lower only 2 feet. Both the main rod and the retaining-piece are preserved from friction by the usual lining. It will be seen that these catches work very efficiently as guides.

Balance-bobs.—The rods should be as nearly as possible balanced, so that when they are empty the power required to move them shall be little more than the friction. With the exception of the case of the United mines, presently referred to, the ordinary pit-work balance-bobs are universally used. The amount of balance used at Dolcoath is 30 tons, distributed as follows:—

		Tons.
At surface.—	Balance behind crown-wheel	5
	Large bob at mouth of shaft	8
	Balance at 90 fathoms	7
	„ 120 „	10
		30

At Carn Brea there is a very large bob at the surface, with a balance of 25 tons, and another at the 70 with 7 or 8 tons. At Cook's Kitchen the balance of 20 tons is distributed as follows: at surface, 7 tons; at 42 fathoms, 7 tons; and at 111 fathoms, 6 tons. At Levant there are four bobs with a balance of about 33 tons. At Fowey Consols there are three—one at surface, and two in the shaft. The balance-bobs are usually attached to the main rod by a long connecting-rod, at least 60 feet in length; this length, with the elasticity of the connecting-rod, allows it to be connected with the main rod in the same manner as the retaining-piece in the catches. At Fowey Consols the connecting-rods are of 3-inch round iron.

These balance-bobs work very well, but are costly, not only in themselves, but in consequence of the considerable room they occupy, requiring frequently the cutting of heavy plats where the old workings are not sufficiently large, or not conveniently placed. The latter difficulty may be sometimes met, as in the case of Dolcoath, where, at the depth of 120 fathoms, the lode had been worked for a great width, but with a considerable underlie, so that to put in a bob in these workings it was requisite that it should be inclined like the underlie of the lode and the rod, so as to work in the same plane as the latter. This arrangement is also sometimes adopted with pump rods. The usual system, however, is to put in the bobs behind the rod in a direction at right angles to the length of the shaft. The same well-known principles which apply to distributing the balance in the case of pump-rods also applies to the balancing of man-engine rods; hence it is evidently more advisable to distribute the balance throughout the depth of the rod than to accumulate it in any one place. The main point to aim at is to insure that the rods shall always work by extension and not by compression.

Hydraulic balances would also be evidently well suited for man-engine rods, wherever they can be conveniently used, particularly as they avoid the oscillation which, under the best arrangements, is to a certain extent inseparable from the use of the ordinary bob. At the United mines there are two ordinary balance-bobs at the mouth of the shaft, and three *balance levers* in depth; one at the adit, one at 40 fathoms, and the third 72 fathoms deeper. A sketch of these levers is given in Plate IV. of the *Report of the Polytechnic Society* for 1845. Although the levers are economical in their first cost, there is a considerable friction from the use of cogwheels, so that they have not been found to answer well on the whole, and have not been adopted in any subsequent engine.

Signals.—The man-engine compartment is always provided with a "knocker-line," for signalling to the surface. At Fowey Consols 1½-inch galvanized wire-rope is used.

Weight of Man-Engines.—The density of Norway pine being ·58, a rod 8 inches square and 100 fathoms long will weigh about 4 tons 6 cwt. In the same length there will be about twenty junctions of the rod, the iron used about which, for strapping-plates, &c., each weighing about 6 cwt., gives a total weight of 6 tons for strapping iron per 100 fathoms. The iron required for the fifty brackets for the platforms in the same length will weigh about 7¼ cwt.; and that for the corresponding handles about 3½. The total weight of a rod 100 fathoms in length will, consequently, be about as follows:—

	Tons.	Cwt.
Wood in the rod	4	6
Strapping-plates, &c., for junctions..	6	0
Brackets and handles.	0	11
Sundry pieces: guides, catches, strapping-irons, bolts, &c.	1	13
Total	12	10

or 25 cwt. per running fathom. If to this we add the travelling or V bobs, and the connecting-rods of the balance-bobs, we have for the depth of Dolcoath, 220 fms., a weight of about 300 tons to be balanced as near as may be by the arrangements stated.

Cost of Man-Engines.—The cost of a man-engine is a matter difficult to estimate with any practical accuracy, for the principal outlay often arises from the cost necessary to put the shaft in a state to receive the engine. Assuming, however, that the shaft is in the required state, we may roughly estimate the cost of the single-rod engine at from £2 to £2 10*s*. per fathom, including in this the balance-bobs taken at an average cost. The mere cost of the rods, platforms, &c. (including strapping-plates and the necessary connections), would probably not exceed 25*s*. per fathom, but the balance-bobs run away with money. One of the most recent engines put up in Cornwall—that at Carn Brea—cost, with the steam-engine (26-inch), about £2,300; but then, as we shall show further on, the cost of the motive power should not be included specially in the cost of the man-engine, for under any system of raising men mechanically this power—indeed, a greater power—would be required. The steam-engine is not necessarily employed exclusively in working the man-engine: when the latter is not working, the former may be used

for drawing, stamping, or any other required duty; the engine at Carn Brea is used for drawing. The estimate of cost per fathom we have given above is not intended to be taken as accurate; it is merely given to convey a general notion, for we intend, on an early occasion, to give the full details of the cost of some of the most recently constructed man-engines in Cornwall.

ECONOMIC CONSIDERATIONS.

Having given the above condensed descriptive notice, we shall conclude by taking a brief review of the following questions connected with this engine:—

The conditions of working, and the results obtained and obtainable;

The types and power of motive-engines most applicable;

Considerations of consumption, expense, and general advantages of man-engines, and particularly of the single-rod type;

And a review of the comparative advantages of the man-engine, and other apparatus for raising miners.

Conditions of working, and results.—In most metallic mining districts the day of twenty-four hours is divided into three *cores* (or *corps*) of eight hours each, thus distributed: from 6 a.m. to 2 p.m., from 2 p.m. to 10 p.m., and from 10 p.m. to 6 a.m., the last core being often wanting. Where a shaft is sinking there are frequently four cores of six hours each, the sumpmen changing at 8 and at 2. To meet these various requirements the engine at Dolcoath is worked thirteen hours out of twenty-four, as follows: from 6 to 9 a.m., from 2 to 8 p.m., and from 10 p.m. to 2 a.m. At Levant they work seven hours out of the twenty-four: from 6 to 7 a.m., from 2 to 6 p.m., and from 8 to 10 p.m.

It follows from this, that man-engines are far from being completely utilised, that is, the rods are never constantly full. In order to arrive at the maximum power of these machines, it will be necessary, for a moment to imagine a working by which they shall be fully employed. As in both systems, the ascending and descending currents go on simultaneously, it will be only necessary to consider one of them.

In the single-rod type every platform may be manned in each up or down stroke, and in the return stroke they can also be manned by those moving in the opposite direction; no platform, in any stroke, need ever be empty. In the double-rod type, on the contrary, the miner only returns to the same rod at every other platform, leaving the intermediate ones as a distinct route for the opposite current; so that, on any one rod, only half the platforms can, under any circumstances, be occupied at the same time.

Now, if L be the length of the man-engine in fathoms, and the platforms be always two fathoms apart, $\frac{L}{2} = P$ will be the number of platforms on each rod.

Let s be the number of strokes per minute made by each rod in the double-rod system, and s' the number of strokes per minute made by the single rod.

Let n be the number of miners to descend; and let t and t' be the corresponding times, in minutes, required to send them down by the double and single-rod systems respectively.

In the double-rod system, the leading miner of the descending current will arrive at the bottom of the shaft after having occupied successively $\frac{P}{2}$ platforms on one of the rods, which will require in time $\frac{\frac{1}{2}P}{s}$ minutes. After the arrival of this leading man of the current, each stroke of the same rod will bring another, so that n miners will be brought down in $\frac{n}{s}$ minutes; so that we have—

$$t = \frac{\frac{1}{2}P + n}{s} \quad . \; . \; . \; . \; . \; . \; . \; . \; . \; . \; (a.)$$

With the single rod type of engine, where the miner must occupy successively *all* the platforms of the rod, we have similarly—

$$t' = \frac{P + n}{s'} \quad . \; . \; . \; . \; . \; . \; . \; . \; . \; . \; (b.)$$

Applying these formulæ to a given case, so as to compare the efficiency of the two types of engines, let us take that of a man-engine extending to 220 fathoms deep, having to send down a core of 200 men: here $L = 220$, $P = 110$, and $n = 200$.

In the double-rod type, working at the rate of the United Mines engine, three strokes per minute, where, consequently, $s = 3$, we have, by formula (a)—

$$t' = \frac{55 + 200}{3} = 85 \text{ minutes},$$

the time required to send down the 200 men by this form of engine.

In the single-rod type, working at the rate of Carn Brea engine, four strokes per minute, and where, consequently, $s' = 4$, we have, by formula (b)—

$$t' = \frac{100 + 200}{4} = 77\tfrac{1}{2} \text{ minutes},$$

the time required to send down the 200 men by this type of engine. A result which shows a balance of $7\frac{1}{2}$ minutes *in favour of* the single-rod arrangement, only working one-quarter quicker.

Indeed, a simple consideration of the subject ought to show the great superiority of the single-rod arrangement. For even if the two types of engine worked at the same rate, although the double rod would send down any *one* man in half the time required by the single rod, the time occupied in sending down *any given number* of men would be the same in both cases when the current had been once established. But the double-rod engine *cannot* be worked at the same rate as the single one; for experience shows, that the number of strokes per minute of the former cannot safely exceed half the number of strokes which may be given to the latter: that is, if the one goes 3 strokes per minute, the other may be worked to 6. Accepting, therefore, that while $s = 3$, s' may equal 6, we see that

the single rod will send down any single man as quick as the double rods, and any given number of men in *half the time*, the current once established.*

To get a general formula for ascertaining the number of strokes per minute, s' required to be given by a single-rod engine in order to perform the same amount of work as two rods each making s strokes, where, consequently, $t = t'$, we have from formulæ (a) and (b)—

$$\frac{\frac{1}{2}P + n}{s'} = \frac{P + n}{s'} \text{ or } s' = 2\,s\,\frac{P + n}{P + 2n} \quad . \quad . \quad . \quad . \quad . \quad (c.)$$

From this equation it follows:—

1. That s' is always less than $2\,s$;
2. And smaller, in greater proportion for the same depth, as the number is greater;
3. That for any given number s' will increase with the depth.

To make these conclusions more intelligible, let us take the case already given where 200 men were lowered to a depth of 220 fathoms in 85 minutes by a double-rod engine working 3 strokes per minute; and let us ascertain by equation (c) the number of strokes per minute of a single-rod engine would be required to do the same work. Here

$$s' = 2 \times 3\,\frac{110 + 200}{110 + 2 \times 200} = 3{\cdot}64$$

that is to say, a little more than $3\frac{1}{2}$ strokes per minute of the single rod would suffice to do the work in the same time as performed by the two rods working *each* at the rate of 3 strokes per minute.

Assuming that $s' = 2\,s$; and taking the case of a deep mine (say 280 fathoms) sending down 500 men per day—200 in each of the day cores, and 100 in the night core—we shall find that while the total time required for sending down the 3 cores with the double-rod engine (working 3 strokes per minute) is 4 hours $32\frac{1}{2}$ minutes, the time required to do the same work with the single-rod engine (working 6 strokes per minute) will only be 2 hours $52\frac{1}{2}$ minutes—showing a saving of 1 hour 40 minutes, or more than one-third of the whole time. Where the motive-engine is employed for other purposes, such as drawing stuff, this saving may be of much importance.

Motive-engines.—In calculating the useful power required to work a man-engine, it is necessary to consider that besides the useful work performed, there is a dead weight to be overcome in the friction and the slight unbalanced weight of the rods. This dead weight of course varies considerably with local circumstances, and particularly with the underlie of the shaft; at the United mines it was estimated that one-third of the motive power was absorbed in the friction resistances.

The weight of a miner may be taken at 150 lbs., and as it is necessary in calculating the power required to assume the maximum that the

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* It is rather remarkable that there seems to be a wide-spread misunderstanding in Cornwall as to the respective capabilities of the two types of man-engines. While the single-rod type has of late been exclusively adopted, there seems yet to be a notion that the double rods are able to do twice the quantity of work, and are only not adopted because such an amount of work is not required.

machine could hold, we shall have, taking account only of the ascending current—

In the double-rod system, on one of the rods (take account only of the ascending current) $\frac{P}{2}$ platforms are occupied. During one minute these will receive $2 \times s$ strokes of 12 feet, the useful power (x) of which, expressed in pounds raised one foot high, will be—

$$x = P \times 2 \cdot s \times 12 \times 150;\ \text{or}\ x = P\ s \cdot 12 \cdot 150 \quad . \quad . \quad . \quad . \quad (\text{d.})$$

In the single-rod system, where the whole number of P platforms are occupied during the stroke of 12 feet, we have similarly—

$$x' = P \cdot s' \cdot 12 \cdot 150 \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (\text{e.})$$

Thus expressed, x and x' have the same form, which we can readily understand, for the $\frac{P}{2}$ miners of the two rods are constantly in movement, while the P miners of the single rod are half their time on the fixed sollars.

If we apply these formulæ to the cases of the United mines and Dolcoath, dividing the results by 33,000 to get the horse-power required, we have—

United mines	$x = 105 \cdot 3 \cdot 12 \cdot 150 = 567{,}000$	$= 17\frac{1}{4}$	horse-power
Dolcoath . .	$x' = 110 \cdot 5\frac{1}{4} \cdot 12 \cdot 150 = 693{,}000$	$= 21$	do.

From this hypothesis, which assumes only one ascending current, let us turn to the opposite one, and consider the two contrary currents in motion; we here find that in the double-rod type there is a permanent equilibrium, the same number of miners always occupying the two rods, but inversely changing from one to the other. In the single-rod engine, on the contrary, the equilibrium is alternative, so to say; that is, if the machine is provided with a sufficiently powerful fly-wheel to store up the motive power derived from the weight of the descending miners, this power will be given out again in the following ascending stroke. The excess of the weight of the rod unbalanced produces the same effect—so that in the two stems there is nothing to overcome but the friction.

These observations clearly show the advantages of the single-rod type of engine. If we suppose the shaft vertical, and $s = 2\ s$, we shall find that the friction in the guides, &c., without being entirely independent of this relation, is far from being proportional to it. The single rod, with its double weight, and with a movement equal to that of the two rods, will not have double the friction, while during its work it will bring up and send down twice the number of men.

Practically, man-engines usually work between these extreme limits; all the platforms are not manned, and the contrary currents are not always equal. However this may be, by the adoption of the single-rod machine, we can profit by the motive-power given out by the weight of the descending core by using a rotary engine with a powerful fly-wheel.

As to the type of motive-engine most applicable to the man-engine, it would appear at first sight that, as a reciprocal motion is required, the ordinary form of pumping engine would be easiest

applicable. However, sound practical considerations have proved that for both systems—the double and the single—rotary engines are the most suitable.

The objection which *à priori* would suggest itself to the rotary engine is that at the end of the stroke corresponding to the dead point there is, properly speaking, only a slackening of speed, not an absolute stoppage. No practical inconvenience, however, results from this in consequence of a certain play of the rods due to their elasticity and mass, and to the great slowness of the movement near the dead point.

It is generally held that, with a stroke of 2 fathoms we cannot safely exceed a rate of 3 strokes per minute in the case of the double-rod type of engine, and 6 strokes per minute in the case of the single-rod type. These rates are evidently equivalent as to the time left to the miner, when we consider that in the one case both platforms are movable, while in the other case one is movable and the other fixed. A simple trigonometrical calculation of the arcs traversed by the crank at the various periods of the stroke, and of the time occupied, will give us the space traversed by the rod within such periods, and establish this point. M. Moissenet, in his memoir in the *Annales des Mines* already referred to, has also shown that, by an arragement which he suggests, the single-rod type of engine could safely be worked as fast as even 8 strokes per minute. In this arrangement the comparative rate of the movement of the rod is expedited in the middle of the stroke, but retarded towards the beginning and end; so that, although the total time occupied by each stroke is reduced from 10 seconds to 7½ seconds, the rate at the beginning and ending of the stroke is not increased.

With regard to safety, there can be no doubt that direct-acting engines, leaving an absolute interval of repose at the end of each stroke, would generally be less safe than the rotary engines now used, which only give a very slow movement about the dead point. The man-engine rod, like pump rods, would then have to start suddenly into motion on the admission of the steam into the cylinder, which would evidently give rise to much more danger than the present mode of slow acceleration at the commencement of the stroke.

Another important economical consideration also leads us to decide in favour of the rotary engine. As the man-engine is not required to work continuously, but yet at such frequent intervals that the steam must be always kept up and the engineers on the spot, it is important that the engine employed be of such a type that it may readily be applied to other purposes. Now the rotary engine is the only one so applicable, as the direct acting engine can never be used for any other work than pumping—and indeed, as will be shown further on, it would not even be good for much for this purpose if it were modified so as to be safe for the man-engine. Besides, a steam-engine of the power required to work a man-engine in a deep mine—about 35 horse-power—is just the engine required for drawing from a similar mine. Such a sized engine would be useless for pumping in a deep mine, and, in addition, in an immense majority of cases the pumping is required to be continuous and not intermittent.

In one case in Cornwall a direct-acting engine has been adapted to

work the Wheal Reeth man-engine, by Mr. George Eustice, jun., of Hayle. In this case the arrangement was adopted in order to utilise an old 30-inch pumping engine which happened to be on the mine, and not deliberately adopted as the most advisable course in case entirely new machinery were being erected. As similar conditions may occur in other mines, in whose special case it may be advisable to adopt a single engine working the rod directly, it may be well to state the modifications which Mr. Eustice has used in order safely to apply this form of engine to working a man-engine.

In the first place no expansion of steam is allowed, for this would necessarily be productive of great danger from the sudden shock given to the rod at the commencement of the stroke; the valves are open throughout the whole length of the stroke of the piston. The amount of steam admitted into, and consequently its pressure in, the cylinder is regulated by the engine-man according to the number of men on the rods; if too much steam is admitted the engine will come "in-doors" too fast, and if too little it will come in too slow. In the case of the rod being heavily laden by men going down, it is also requisite to take precautions against its going "out-of-doors" too fast, which would necessarily occur if, at the end of the in-door stroke, the equilibrium valve were suddenly opened with a rod heavily manned. For this purpose a throttle-valve is placed in the top of the vertical pipe connecting the equilibrium valve; by this the rate at which the steam is allowed to pass from the top to the bottom of the cylinder is regulated at will, and with it the rate at which the piston ascends. The whole of this arrangement is very creditable to Mr. Eustice, for circumstances may occur where the adoption of an engine of this kind would be economical, and before he took it in hand it was deemed impossible safely to apply a single-acting engine for the purpose.

Consumption and Expenses of Man-Engines.—It must be evident that the consumption of coals, grease, &c., and the other steam-engine charges, must vary with the varying circumstances; and besides, as the motive-engines are usually employed in doing other work, it is not always easy to apportion the respective proportion of cost which should be set down to each. At the United mines the cost on the man-engine has been estimated at £30 per month. In the case of Levant, where the motive-engine also draws from a depth of 79 fathoms, and where its total cost is £25 5*s.* per month, M. Moissenet calculates that $\frac{3}{5}$ths of this should be apportioned to the man-engine, which would give £15 3*s.* per month. If to this we add 17*s.* for grease, &c., used underground, we have a total monthly cost of £16. In the case of Dolcoath, similarly, where M. Moissenet apportions half the steam-engine cost to the man-engine, he gets a monthly charge of £16 8*s.*, which, however, is probably much under the mark. As we shall take the opportunity of giving on an early occasion detailed particulars of the monthly cost incurred in working the various man-engines in the county, together with the number of men transported, and the depths, it is unnecessary to dwell further upon these generalities.

Advantages of Man-Engines, particularly the Single-Rod Type.—The enormous loss of labour and time incurred in climbing ladders is

well known—indeed, too evident to make it necessary to dwell upon it. To go down by ladders to the depth of 250 fathoms a miner will occupy about 40 minutes, and to climb the same distance he will take about 1 hour, or 1 hour 40 minutes in the descent and ascent. In the man-engine he can go up and down in 25 minutes each way, 50 minutes in all, which gives a saving of 50 minutes, or more than $\frac{1}{10}$th, in time of the miner's working day. The saving in fatigue and labour probably amounts to as much more, so that the saving by the application of mechanical means varies from $\frac{1}{4}$th to $\frac{1}{5}$th, and is certainly never less than $\frac{1}{8}$th on the labour expended. This is the mere money question, but besides this there is the question of health.

What has been already said must have sufficiently demonstrated the superiority of the single-rod type of engine; but still it may be well to give a summary of its advantages in a short compass.

1. It is less expensive, and occupies less space.

2. It is safer in several respects. In the first place, the shaft at each two fathoms may be sollared over, only leaving the man-hole, so that in case of a man falling away there would be a fair chance of escape. In the next place, the danger of stepping on to a moving platform is much greater than on to a fixed one; and besides, in case of a man getting giddy, he can rest himself as long as he desires on any sollar, while in a similar case in the double-rod engine he would be carried up and down with each stroke of the engine, which would very likely make him worse and insure his destruction.

3. As it can be worked twice as quick, each man can be sent down in the same time as with the double-rod engine, and the *same number of men* can be sent down in *one-half* the time—when the current is once established—a matter, of course, of immense importance.

4. The power utilised is greater; and as the motive-engine is generally used for other purposes, the amount of time left available for these purposes is greater.

Hence it is evident that the double-rod engine is inferior in every element required. It is necessary to insist strongly upon this, for the fact does not seem to be properly understood by certain Cornish engineers. Its adoption is very creditable to Mr. West and the late Captain Puckey; for while the first engines erected at Tresavean and United mines were nearly copies of the German originals, the Fowey Consols engine started with an independent principle.

To get a general formula for the performances of man-engines, whatever may be the distance of the platforms apart, we have the following, taking d = this distance:

$$t = \frac{L}{d \cdot s} + \frac{n}{s}$$

Putting $d\,s = V$ the velocity of transportation, we have—

$$t = \frac{L}{V} + \frac{n}{s}$$

which shows the time necessary to send down n men to a depth of L fathoms, making s strokes per minute of d fathoms each. The activity will be greatest when the values of d and s are such as to reduce t to a *minimum*.

Comparative advantages of man-engines and other mechanical means for raising miners.—This very important question, which, as has been said, has recently been much discussed in Cornwall, is one on which a good deal may be said on both sides. In favour of the man-engine we have the following considerations:—

1. It is safer—that there can be no doubt about.

2. Being once fixed in place, it will send down or take up a greater number of men in less time, and at a less cost, than can be accomplished by any other means; this is equally clear; for by no other appliance can we deliver a continuous stream of men to a depth of say 300 fathoms, at the rate of 360 men per hour, with engines of the size described.

3. Any man can leave or get into the engine at the level of any sollar, which in metallic mines is a matter of great importance, where workings are carried on at so many different levels.

Against the use of the man-engine as compared with skips or other similar appliances used in collieries, it has been urged:—

1. That although the man-engine may be the safer, yet as it can be so seldom applied (seeing that there are only 8 in Cornwall), its general non-applicability, which still perpetuates so much climbing, really causes more injury to health and life than would be at all likely to arise from the general practice of sending down men in well-arranged skips with wire ropes.

2. That although cheaper and more expeditious when once established, yet, since it necessitates the putting up of special machinery at an extra cost, and above all requires an extra space (not often available), it really brings little economy in the end. On this point, the advocates of the skip also urge that the general application of the same means to raising men as are used for raising ores, would necessarily lead to an improvement of the latter, in which Cornwall is undoubtedly backward, and consequently lead to great economy.

It is quite clear, regarding the matter candidly, that there are points to be urged on both sides. Skips with wire ropes, such as men might be sent down by with *reasonable* safety, ought to be on every mine, and in every working shaft, for the sake of economical drawing alone: man-engines can never be so commonly used. Hence, the rational views would seem to be these:—

1. Where the depth of the mine, the number of men employed, and the general prospects are such as to justify it, and where the extra space required is available without much increased cost, the putting in of a man-engine is the most advisable course.

2. Where these conditions do not occur there is no reason why skips should not be put in, and used with sufficient care, to enable men to be raised and lowered by them. They could never, probably, be made quite as safe as the man-engine, and certainly would not be so economical; but they could be made *reasonably* safe, and under any circumstances would be found cheaper than climbing ladders. In fact, both in the matters of safety and economy, they would be very much better than leaving things as they are—although not so good as man-engines. For instance, by way of comparison, we may admit that a railway is the best of all modes of travelling; but we cannot have railways everywhere, and where we cannot have one, we

may be content with a good macadamized road as better nothing. So with man-engines and skips; the former may be adn to be the best when they can be had, but as they are not so u sally available as the latter, we must be content to use skips i great run of mines.

There are only two skips at present in work in Cornwall by men are regularly sent up and down. One at South Frances in which Lord Kinnaird, the Chairman of the Metallic Mines mission recently went down; and another at Botallack, by H.R.H. Prince Arthur went down a few days since.

Illustrated Notes on Prominent Mines.

By the Editor.

EAST POOL.

East Pool is situated in the great mining district of Camborn Illogan, at the foot and to the north of the granite range of Brea. The metalliferous lodes which course nearly east and with this granite hill to the north of it, for a length of upwa 2¼ miles, from the boundary of Redruth parish to Camborne may be classed into four zones, which, taking them from sou north—that is, in succession as they recede from the granite—a follows:—

1st zone, nearest the granite, which comprises the mines of Brea, Tincroft, part of East Pool, Cook's Kitchen, Dolcoath, Park, and Camborne Vean. In this zone the backs of all the cipal lodes are in the killas, but they all enter the granite in de generally above the 110 fathoms below adit. In the northern of this zone there are several elvans, which principally dip north from the granite; and in the middle of it, between the and north runs of lodes, a regular underground ridge of granit been traced, rising at places to within 70 fathoms of the surface

2nd zone, comprises Wheal Tehidy, part of Wheal Agar and Pool, South Crofty, and South Roskear. There are several elva this zone, but no granite had been met with until the recent very at East Pool, which I shall refer to further on.

3rd zone, which comprises North Pool, part of Wheal Agar, N Crofty, and North Roskear. Elvans are also met with here.

4th zone, comprising West Tolgus, East Seton, Wheal Seton, West Seton.

Of course such a division as this is arbitrary, particularly w there are caunter lodes running from one zone into the other, as i case of the great caunter lode which extends from Pool thr North Crofty to Old Wheal Crofty into Wheal Seton. But st is convenient, and will aid to give a notion of the position o various mines, and their relative distances from the granite.

The transverse section shown in plate 5 is drawn across Brea and East Pool setts, and shows Teague's lode, Fanny

Highborough lode, and East Pool south lode, classed in the 1st zone; and East Pool north lode, classed in the 2nd zone. The section is not entirely in the one line, for the portion of Carn Brea sett in which the 60 and 80 cross-cuts north are driven is not opposite the 48, 70, 100, and 120 cross-cuts in East Pool: indeed, this East Pool south lode (or Tincroft north lode) crosses at a small angle the boundary between East Pool and Carn Brea, and is, for a portion of its length, in the latter sett—to which portion the 60 and 80 cross-cuts shown were driven. The difference, however, arising from the section not being all in the same plane, is not material, and in no way affects the general view the section is intended to give.

Dipping down from Carn Brea hill, it will be seen that the granite intersects Teague's lode and Fanny lode (south underlyers) at the respective depths of 50 and 80 fathoms below adit, the Wheal Fanny shaft passing into the granite at the 70. In this line the granite seems to dip about 20 fathoms deeper, when it takes a rise again upwards, going considerably above the 60 cross-cut north, which has been driven through it to East Pool south lode, where the granite again dips pretty rapidly north, forming the south wall of that lode as far as has been yet seen. This underground ridge of granite, which for the sake of distinction I shall call the "first ridge," can be distinctly traced for at least a mile and-a-half running parallel with the main ridge of Carn Brea; in Dolcoath it occupies precisely the same position as in Carn Brea, although it appears not to be quite so large.* The occurrence of a tolerably large, and for a considerable distance so regular underground ridge of granite, has always seemed to me to be a matter of peculiar interest—worthy of much greater attention than it has yet received, for it seems to indicate conditions in the eruption of granite which have not been hitherto understood.

But the interest which attaches to this first ridge is much enhanced by the discovery of a second ridge lying still further north recently made in sinking the north engine-shaft at East Pool. This shaft, as will be seen by the transverse section, is sunk perpendicular to the depth of 5 fathoms below the 120, where it intersects the north lode. Upon the intersection of the shaft with this lode it was proposed by some of the adventurers to continue the sinking of the shaft on its underlie. Fortunately, however, at the pressing instances of the manager, Captain W. S. Garby, this was not done, for if it had the recent discovery would not have been made—at least at present. It was agreed to continue the sinking of this shaft perpendicular; and in about 15 fathoms sinking, that is at about 5 fathoms below the 130, it came down suddenly on granite, and at the same time on one of the most extraordinary bodies of mineral ever met with in Cornwall, which upon being cut into north turned out to be a great lode, upwards of 12 feet wide, made up of mundic, copper, tin, and wolfram, in great quantities.

Subsequent explorations have shown that just above where the shaft intersected the lode a "dropper" a few inches wide went off,

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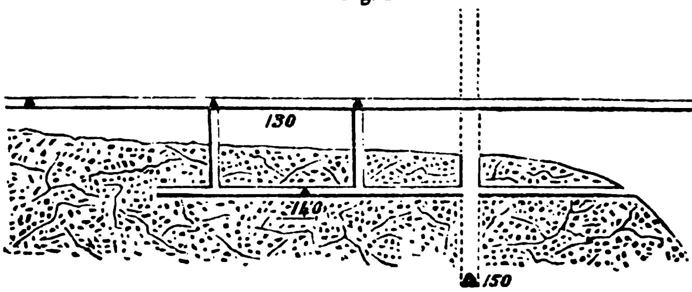
* Compare the cross-section given in Captain Charles Thomas's "Remarks on the Geology of Cornwall and Devon," p. 19.

underlying north. This dropper, as seen by winzes since sunk upon it, continued as little more than a string until about 4 fathoms below the 130—that is, 6 feet above the granite—when it *quite suddenly* opened out into a lode 12 feet wide, underlying a little north. The accompanying section (Fig. 1), on a scale of 22 fathoms to 1 inch,

Fig. 1.



shows the extent to which the workings have been extended on this new lode. Going east in the 140 from the shaft, the granite is found to dip, and in about 18 fathoms driving the level is again in killas, where the lode is found to decrease to a mere string. Going west, the granite rises towards the 130, but not very rapidly, as will be seen from the section. From the 130 to the 140 two winzes have been already communicated, and a third is about being commenced, in the position shown in the section, to come down on the 140 end west. A cross-cut has also been commenced from a point between the two winzes already communicated, which is being driven south to intersect the continuation of the old north lode; this lode has been sunk on 7 fathoms deep below the 130, as shown in the transverse section, where it is 8 inches wide, and rather promising looking. The cross-cut has been driven about 6 fathoms, and has about 4 fathoms more to drive to cut this lode.

The engine shaft is now down to the 150, and the cross-cut north to the new lode is being driven with all speed, which it may be expected to cut early in June. The result of this level is looked forward to in the district with great interest, not merely by those interested pecuniarily, but by all parties. Great differences of opinion exist as to the probable continuance of such a large lode, opening out as it has done just on the junction of the killas and granite, for a permanency. The lode in the granite already opened on has been rich for tin and copper, but these have been mixed up so much with other minerals—particularly with wolfram—that their commercial value has been much deteriorated. At one point of the lode, in the stopes below the 140, on the north, there is a mixed course of tin and copper 9 feet wide, worth £75 per fathom, on the south side of which there is a solid branch of wolfram 4 feet wide, interspersed with a few strings of copper and mundic. The opinion of those most interested in the mine—with whom, no doubt, "the wish is father to the thought"—is that the wolfram and other impurities, which are now so troublesome, will die out in depth, leaving a large

and rich lode of copper and tin. I sincerely hope that this may turn out to be the case; I think there is a very fair probability of its being fulfilled. The opinion of those who take an adverse view is that the deposit is in the nature of a "floor," forming at the junction of the killas and granite; but in the stopes at the bottom of the 140* there seems no indication of any falling off.

Turning, however, from these questions of merely personal interest, let us look at the bearing of this discovery on the district in general. If we take a broad view we find that almost all the main lodes have made rich at some point or other more or less shallow; but unless they can get into the granite there seems no chance of rich deep mines. Mines in the second and third zones have made rich to some considerable depths, but mostly in connection with elvans. At South Roskear and North Roskear the lodes have intersected two main elvans: above the first, both mines were rich; between the first and second they have about paid cost; below the second they have been poor. The mines of the fourth zone seem to make more in connection with a great run of greenstone which flanks the granite at some distance off.

The proximity of the granite to the lodes of the northern zones in depth is consequently a matter of the greatest interest in a view of the future of this district. In Dolcoath, Cook's Kitchen, and others of the 1st zone, the mines are turning out richer at the depth of 300 fathoms than they ever were above, although they have returned mineral produce to the value of millions upon millions. There seems every probability of mines reaching a depth of 400 fathoms in this zone; indeed, with a high price for tin, they seem practically inexhaustible for a couple of generations; and the only difference between the lodes in this zone, and those of the two to the north, is that in the first they have entered the granite, while in the latter they have not done so. If the lodes of the northern zones are likely to enter the granite within practical mining depths, who shall say that they will not be equally rich, and that this great district, which has already done so much, is not in its infancy for real deep mining—mining below a 250 or 300-fathom level?

The difference which the rising up of the ridges causes in the depth at which the lodes may reach the granite is easily estimated. If the granite of Carn Brea continued to dip regularly as it does from the surface to its intersection of Fanny lode, it would not catch the Highborough lode until the 180 instead of the 60; and as to East Pool north lode, which has now got the granite at the depth of 135 fathoms, it would not intersect it under a depth of at least 500 fathoms—in which case the large lode recently found, which evidently makes in connection with the granite, would never have been seen. Even if the first ridge had continued its regular dip, the lode would not have reached the granite before the 220. If this second ridge rises still more going north, as indicated by the dotted line, and which seems to be the case, the lodes of the northern zones may be much nearer the granite than has been suspected.

* The necessities of the mine have obliged some fathoms of ground about the engine-shaft, 7 fathoms on the west and 8 fathoms on the east, and 3 fathoms deep, to be stoped underhand.

It will be seen that the East Pool south lode runs down all the way on the junction of the killas and granite, having the former on the north side and the latter on the south side. This is a mode of occurrence which is common enough in Cornwall, and it seems to me well worth considering whether or not we should deem this lode to be a fault, throwing down the granite 90 fathoms south. If it is to be considered a fault, then the second ridge of granite must have been originally much nearer the surface than it now is. This and several similar phenomena in Cornwall are certainly worthy of a much greater amount of attention than they have hitherto received.

Abstracts and Reviews.

MR. JUKES' MANUAL OF GEOLOGY.

The Student's Manual of Geology. By J. Beete Jukes, M.A., F.R.S., Local Director of the Geological Survey of Ireland, and Lecturer on Geology to the Museum of Irish Industry. Edinburgh: Adam and Charles Black.

In this *Manual* Mr. Jukes classifies his subject under the three following heads:—1, Geognosy; 2, Palæontology; and 3, The History of the Formation of the Series of Stratified Rocks. Under the head of Geognosy, he classifies the study of the structure of rocks independently of their arrangement into a chronological series, subdividing the subject into two parts—Lithology and Petrology; meaning by Lithology the study of the mineral character and texture of rocks, and by Petrology the study of the larger characteristics of rock masses—their forms, positions, mutual relations, and other characters that can only be studied in the field—but without entering on the question of the geological time of their production. This Geognosy division, which occupies half the volume, is, as we have already said, the characteristic feature of Mr. Jukes' work. The title is well chosen, for the sense to which the author here limits it is about the original meaning of the now (in this country) exploded word geognosy. On the Continent, by some writers particularly, it has received a wider sense, being made to include to a great extent what we generally understand by geology—the latter word being only used as describing the *Past* History of the Earth. Thus Naumann divides geology into two parts—Geognosy and Geogeny, only giving the former name to his great work, which is really the most complete and exhaustive treatise yet written on the science of geology. The nomenclature of the two subdivisions of Geognosy is not altogether so satisfactory. The name Lithology, as applied to the study of the mineral character and texture of rocks, is unobjectionable; but the use of the word Petrology, in the sense employed by Mr. Jukes, is rather confusing, as the word Petrography is commonly used in about the same sense as he uses Lithology. Certainly "Petrology" does not at once suggest to the mind the subjects to which Mr. Jukes' definition applies it, and we think he could find a better name for this division of his subject: "Geotektonick" is the word Naumann uses for this section of Geognosy, and although the nomenclature of this author may seem to us over pedantic, and savouring too much of the excessive classification in which German minds delight, there are still great advantages in following as nearly as possible such a great classical work as his "Geognosie," and con-

sequently we think that some modification of "Geotektonick" would be preferable to Petrology.

Turning to the chapters treating of Lithology, we find a sufficiently full and reasonably clear description of the chemical composition of the principal rock-forming minerals. It is a remarkable thing that there are but few people, even among geologists, who have any clear notion as to the chemical constitution of rocks, or are really aware how essentially simple their composition is. Generally speaking, it seems to be imagined that the mineral crust is composed of a jumble of almost all the elements—a notion certainly favoured in the student's mind by mineralogy books, which place on the same footing minerals like quartz and the felspars, and species of which a few ounces only have ever been found. Hence the chapter in this *Manual* on the chemical composition of rocks supplies a decided *desideratum*. We cannot say we think that Mr Jukes is fully alive to the most recent advances made on this subject on the Continent, or that he takes a sufficiently broad view of the genesis and transitions of mineral species (so-called); but as these are still matters of controversy they are probably wisely excluded from a work intended professedly for students.

The truth is that the real scientific study of mineralogy has been retarded half a century by the mistaken course given to that science by a few eminent men, whose aim has been to isolate mineral species by an excessive and often artificial classification, and to dwell rather upon their differences than to search out their analogies and mutual relations. This is due, to a great extent, to what we venture to call—even at the risk of being misunderstood—the excessive importance attached to crystallography. If we regard minerals in a geological sense—that is, if we take a wide scientific view—it is evident that we must look more to their chemical composition and paragenesis than to their crystalline form; and consequently the exclusive importance which has been given to the latter has led us away from the true track. Without undervaluing crystallography, or doubting that it will *ultimately* be found of inestimable scientific value, it must be remembered that *at present* it has no great value beyond that of aiding the recognition of species. Until we know the reasons why certain species take certain forms, the value of crystallography in elucidating the larger problems of mineralogical geology may be considered as non-existing. Indeed, the old mineralogists, who regarded mineral species merely as rock constituents, and considered their description as only preliminary to a description of the latter, were nearer the truth than the authors of modern mineralogy books; for a study of minerals in their relations as rock constituents leads us to the great problem of this branch of geology—the paragenesis or association of minerals.

The paragenesis or association of minerals is a subject not merely not generally understood, but it is one of which we may safely say few people know the existence. With the exception of Breithaupt's work,* a few memoirs scattered through German periodicals, and we may probably add a portion of M. Delesse's memoir "On Pseudomorphs," in the *Annales des Mines* (sixth series, vol. xvi, p. 317), there is scarcely any literature on the subject. Yet it is of all others the most important branch of mineralogical study, for nothing is more certain than that minerals are not associated together *promiscuously* in rocks or veins, any more than are the chemical elements in the constitution of minerals: there are certain laws of association, or paragenesis, regulating the "occurring together" (*Zusammenvorkommen*) of mineral species, of which we have as yet but a faint glimmering, but which, when fully investigated and understood, can scarcely fail to throw a flood of light on the laws regulating their origin. This is the

* Die Paragenesis der Mineralien. Von Prof. Dr. August Breithaupt, Frieberg, 1849.

widest meaning of the word paragenesis; but it is very generally used in a narrower sense, although one not without interest and importance, which regards rather the "succession" (*Sukzession*) or the relative order of crystallization of minerals—and in this sense it seems to be employed by Mr. Jukes. As Breithaupt truly says, the study of the paragenesis of minerals is one essentially connected with that of metalliferous veins. With the metallic miner it originated, and by him alone is it really studied —generally unconsciously. When a miner says that the occurrence of a certain mineral species or a certain family of minerals is "kindly" for the production of another mineral family of economic value, he enunciates a paragenetic law, and really possesses a knowledge (confused, no doubt) of a higher branch of mineralogy than is dreamed of in the more correct but decidedly narrow philosophy of the cabinet mineralogist who, however glibly he may "chatter stony names," and however anxious he may be to teach the miner his little science—necessary enough in its way—always fails to impress the latter with his knowledge. The miner knows right well that he possesses more real knowledge than his would-be teacher, although he is incapable of expressing it, and has, probably, never indeed formulated it in his own mind.

In considering rocks, Mr. Jukes classes them under four heads—Igneous, Aqueous, Aerial, and Metamorphic. The Igneous are all chemically formed; the Aqueous may have either a chemical, mechanical, or organic origin; the Aerial are all mechanical, while the Metamorphic are those which belonged originally to one of the foregoing classes, but have been "altered" by subsequent action. This is a good practical classification, but scarcely capable of being carried out scientifically. Indeed, no single classification can include the consideration of every circumstance connected with the origin of rocks; our classification must vary according to the point of view in which we are to regard them. If we look to the materials from which they were derived, we may class rocks into *Minerogene*, *Zoögene*, and *Phytogene*, according as their principal source is mineral, animal, or vegetable. According to the probable mechanical conditions of their origin, we may class them as *Eruptive*, *Klasticine*, or *Metamorphic*, for it is evident that all rocks have either been thrust up from beneath, thrown down from above, or been altered in place. The word klasticine (from κλαστός) used above we have ventured to borrow from the French and German geologists by whom it is frequently employed, as it seems highly convenient, there being no word at present in use answering to it, for the word sedimentary implies a deposit from water, and that in a fine state, thus excluding all aerial-formed rocks, and those made up of large fragments; while the distinction of chemically and mechanically originating rocks is too indefinite to have any scientific meaning. We may again class rocks as aqueous, igneous, or aqueo-igneous—*hydatogene*, *pyrogene*, or *hydatopyrogene*—although as a rule it is better to avoid founding a classification on geological questions of this kind, which imply a theory. For this reason we object to the word "igneous" employed by Mr. Jukes, and by the geological survey, as designating the great body of crystalline rocks, for, to say the least of it, its most obvious meaning involves assumptions upon which recent inquiries have thrown great doubt; the word "eruptive" would be much more satisfactory. We think, also, that the term "klasticine"—used in a sense to comprise all rocks thrown down from above either mechanically or chemically—might with convenience be used to include the aqueous and aerial classes of Mr. Jukes. No doubt there is an inconvenience in introducing new words, but this inconvenience is less when they are already in use by the standard authors of foreign countries.

However, these are very minor matters. In the classification of rocks and the discussions as to their mode of origin, this *Manual* is decidedly the best English elementary work. There is a freshness about the descriptions,

and a knowledge of valuable details and distinctions, which mark the experienced field-geologist, and give them a peculiar value to students of economic geology.

Turning from the chapters on Lithology to those on Petrology we find Mr. Jukes even still more at home with his subject. Occupying as they do 300 pages of the volume, we can safely say that in no other English elementary work can the same information be met with. From Mr. Jukes' experience among the coal fields of the Midland Counties, he is enabled to give us an unusual amount of illustration of great practical importance on the faults and disturbances met with in the carboniferous rocks. A great number of the illustrations, too, are derived from Irish localities, many of which are very interesting as the geology of that country is not very generally known. Ireland seems, from the number of instances given, to be particularly rich in the jointed structure of rocks.

To miners the chapter on Faults or Dislocations will be found of great value, for the matter is not generally as well understood as it should be. In it Mr. Jukes gives another example of that rare occurrence, a reversed fault—an occurrence, however, which, although rare, is scarcely so very exceptional as Mr. Jukes seems to consider it. An instance of one was shown in Mr. Fryar's paper in our April number, and the additional example given by Mr. Jukes is from a colliery in the Queen's County.

The chapters on Cleavage and Foliation, on Denudation, and on Unconformability and Overlap are full of interesting matter, some of which is quite new. The chapters on the geognostic characteristics of the eruptive rocks are also full of interest.

In the chapter on Mineral Veins (which would be more correctly Metalliferous Veins) we naturally look for little more than a simple statement of some of the best known facts, and these we have. We know so little on this subject, and so much of what we supposed to be accurate knowledge turns out to be mere hearsay and entirely worthless, that the probability is we shall have almost to begin *de novo* in our inquiries. We certainly have the writings of Mr. W. J. Henwood and Mr. Warington Smyth, which are entirely reliable—both being practical men, conversant with underground operations; but neither of these gentlemen have favoured us much lately. Many, indeed most, of the inquirers into the phenomena of metalliferous veins have been content to take their information at second-hand; in fact there was no other course open to them, for the examination of underground workings by persons unaccustomed to them is a mere farce. It requires an apprenticeship of years before a man can be competent to decide on minute facts in the dirt and gloom of a mine, and the labour which that involves is a matter none have been found to go through but as a matter of business.

Mr. Jukes is quite right in pointing out that there is no connection between the age of rocks and the occurrence of metalliferous veins, which may be expected in rocks of all ages where the necessary disturbing and metamorphosing actions have taken place. But we think he goes too far when he denies that there is any relation between metalliferous deposits and certain classes of eruptive rocks, or "igneous" rocks as he calls them. It must of course be admitted that we have not yet been able to trace any relation capable of being scientifically defined; but still the experience of the greater part of the world, showing a general connection between certain eruptive rocks and certain classes of metalliferous veins, is too strong to be lightly passed over. *Mineral* veins occur in almost every kind of rock, and frequently necessitate for their production all required conditions of disturbance, but these are not necessarily metalliferous. In connection, however, with certain classes of eruptive rocks (rocks known to miners as "congenial") those veins do become metalliferous, showing seemingly a certain paragenetic relation between these classes of rock and certain

metalliferous minerals. Of course this association may be accidental, and we should be slow to found on it rash hypotheses; but, on the other hand, it is not to be put hastily aside.

The next chapter on "The Art of Mining" is, of course, merely popular, but it puts prominently forward the distinction between Bed Mining and Vein Mining, which miners themselves frequently fail to keep sufficiently distinctly in view. This concludes the First Part, and brings us to the Second, which treats on Palæontology.

In devoting a special division to Palæontology before entering on the description of the Series of Stratified Rocks, Mr. Jukes follows the example of Naumann—as he does indeed in the general arrangement of his volume. The advantage of this to students is, of course, immense, for here they can learn in a consecutive form the leading facts and principles regarding the revolutions of life on the globe instead of picking them up bit by bit in the course of the volume. In the three chapters which are devoted to the subject in this *Manual*, the reader will find one of the clearest and most philosophical expositions of palæological doctrine easy to be met with in such a small compass. On the philosophy of geology Mr. Jukes is in the advanced ranks of the holders of Lyellian doctrines, and consequently we meet with none of those ancient prejudices which so warp the judgment of other able geologists. Since the last edition of his work he has evidently been affected by certain recently-propounded doctrines on biological science and being—like his colleague, Professor Huxley—of that "honest few" who scorn to blind their judgment in order to fall in with the popular current of the hour, he indicates his opinions fairly, without ostentation or without reserve.

Part III., the "History of the Formation of the Crust of the Earth," which occupies nearly 300 pages, is much improved compared with the last edition, in which there were no illustrations—either sections or figures of fossils—which in the present edition are abundantly given. This part teems with new matter, a good deal of which is, of course, derived from the Survey.

The whole concludes with an appendix on Geological Surveying, which will be found of much value to practical men. We may add that there is a most copious index, a matter of the utmost importance in a work of this kind, making it a dictionary of geological reference.

SOCIETY OF ARTS.

At the meeting of this Society on the 14th May, Thomas Sopwith, Esq., M.A., F.R.S., in the chair, the following paper was read:—"Gold Mining and the Gold Discoveries made since 1851." By J. Arthur Phillips, Esq.

It would be obviously impossible to attempt to give within the limits of the present paper, a detailed account of all the valuable gold discoveries which have been made within the last ten years, and I shall, therefore, necessarily confine myself to the more important only, but shall, at the same time, briefly notice the various modifications which experience has introduced into the processes for treating auriferous ores, and succinctly advert to some of the causes which have unfavourably influenced this class of industry. Gold is usually found in a quartzose gangue, traversing altered palæozoic shales, and these deposits are frequently richest in the vicinity of eruptive rocks. The oldest stratified rocks have been seldom found auriferous, but the sedimentary deposits which follow in the series (those generally ascribed to the Silurian, Devonian, and Carboniferous epochs) have, particularly when highly metamorphosed, yielded the largest amounts. Of these, those usually described as Silurian rocks have been by far the most productive, but instances are not wanting, even in Europe,

of small quantities of the precious metal having been found in the conglomerates of the Carboniferous period.

Gold almost always, if not always, occurs in the native or metallic state; generally in the form of small flakes or granules, but occasionally in masses of considerable weight. It is never pure, being invariably alloyed with silver, and frequently contains small proportions of iron and copper. Gold is also often associated with various metallic sulphides, such as copper pyrites, galena, blende, and particularly with iron pyrites, and mispickel. It appears somewhat doubtful whether, in every instance, all the gold in metallic sulphides exists in the form of minute metallic particles, or if, in some cases at least, it may not be present in combination with sulphur. I may, however, observe that from the results of numerous experiments on this subject, I am inclined to the belief that gold does sometimes occur in small quantities in the form of sulphides, but that oxide of gold, for the extraction and utilization of which sundry much-vaunted processes have been devised, does not exist in any of the known auriferous ores. The extraction of gold from the sulphides would by the ordinary process of amalgamation, present considerable difficulty, and consequently, it will often be found advantageous to separate and collect the pyrites, &c., contained in the tailings, and subsequently to subject them to metallurgic treatment by fusion either with galena, litharge, or some other lead product.

The most important gold discoveries made during the last ten years are those of British Columbia, New Zealand, and Nova Scotia; but it may also be observed that gold in paying quantities has been recently discovered in the neighbourhood of Dolgelly, in North Wales.

British Columbia.—As early as June, 1856, Mr. Douglas, the Governor of Vancouver's Island, reported to the Secretary of State the discovery of gold in the British territory, north of the 49° of latitude, and stated that the earnings of the diggers ranged from 2*l.* to 8*l.* a-day. In consequence, however, of the hostile attitude assumed by the natives, the number of diggers was very limited. Altogether this discovery attracted at first less attention than might have been anticipated, but in December, 1857, Governor Douglas reported that the Indians themselves were extensively engaged in the search for gold, and that the accounts which had reached the neighbouring states of America had caused considerable excitement. It was not, however, until May, 1858, that a stream of immigration sufficient to overpower the opposition of the aborigines had fairly set in, and the British public learnt, for the first time, that the mainland of New Caledonia, as the district extending from the Red River to the Pacific was somewhat vaguely designated, was a rich and beautiful land, which gave every promise of becoming a flourishing and highly important colony.

The *Times* correspondent, writing from Victoria, Vancouver's Island, under date of January 20th, of the present year, says:—"Beginning with Fraser River, the main artery of the auriferous region, I may state that gold is known to exist, and has been worked at a great many places in the river and on its banks, from a point about 45 miles from its mouth up to near its source in the Rocky Mountains; in other words, from the 49th up to the 53d parallel of north latitude, a distance (taking in the windings) of some 800 miles. The south branch of the Fraser has its source near Mount Brown, in the Rocky Mountains, in about 53° north latitude, 118° 40′ west longitude. Thence this branch flows for 290 miles to Fort George, a post of the Hudsons' Bay Company. The north branch rises in an opposite direction. It receives its supply from a series of lakes lying between 54° and 55° of north latitude; longitude about 124° 50′ west, and runs a course of 260 miles to its junction with the south branch, some miles below the 54th parallel of north latitude. Here the union of the two branches form the Fraser River proper. Adding the north branch, which

is also a gold-bearing stream, and which was worked last season, to the other arm, the two will give us a continuous stretch of auriferous riverain territory upwards of 1,000 miles in length, extending for many miles back into the country, but not including the tributary rivers which fall into the Fraser. In short, the river itself is now known to be auriferous, and to pass through a gold-bearing country throughout its whole course. Gold is also found in most of the tributaries of the Fraser, of which no less than 59 are known. The great length of the main river, and the number of its tributaries, will give some idea of the auriferous resources of the country. But these facts do not by any means convey a comprehensive or accurate view of the vast extent of the area of the gold field, because they are limited to the central portions of the country, while the whole of the upper portion of British Columbia, from its southern to its northern boundary is auriferous. Besides the gold found in the beds and on the shores of these streams, the Fraser itself and many of its tributaries are skirted and bordered by terraces, all of which yield gold also. These terraces, or benches, as the miners call them, run at intervals along both sides of the rivers for miles in length, and they recede where the mountains retire for distances back into the valleys varying from a few acres to a few miles in breadth. They are objects of curiosity and speculation, and add much to the beauty of the rude scenes in which they occur, from the regularity and evenness of their structure. They generally occur on both sides of the river (opposite to each other) at the same place, sometimes at the same elevation on both sides, and sometimes at different elevations, high on this and low on the other side of the river, and in some places they are multiplied into several successive level parallel plateaux, rising one above the other as they recede from the bank. These terraces are composed of the ordinary alluvial deposits, loam, gravel, stones, sand, and boulders, and they are thick masses, rising generally to a height 150 to 200 feet."

From the statement of the same writer, there would also appear to be abundance of gold found in other localities besides the vicinity of the Fraser. Large yields have been obtained from the diggings between Fort Hope and Fort George, about 100 miles from its mouth. These mines are said to have yielded during the last season an average of $17 to the hand, and a party of three men took from three days' digging $240. At Okanagan, 60 miles distant, the average produce is stated to have been $4 to the hand. The Thompson River and its tributaries had also proved highly auriferous. North River gave from $8 to $10 to the hand, and on the Barrière a community of French Canadians made each as high as $50 per diem. Cariboo, however appears to be the largest and richest of all the gold districts hitherto discovered. In confirmation of this, it may be stated that at Steele's claim, Williams's Creek (Cariboo), a company of five partners commenced their operations during the summer months. They began their preparations by sawing timber for their sluices, and at first their claim did not promise so much as many others. During the first three days they obtained little or nothing, but on the fourth day their labours were rewarded by the collection of 4 ozs. of gold. On the fifth day they made 10 ozs., and on the sixth 41 ozs. From that time the yield went on increasing until it reached 387 ozs. per day, whilst the last day's work gave them a return of 469 ozs. The five partners employed four hands to assist them in clearing away the tailings. The labourers were paid $8 per day each, in addition to their board, and the total value of the gold raised during not more than two months' actual work was equal to a money value of 21,875*l*. The total area of the claim so worked was 80 feet by 25 feet, thus showing the extreme richness of some of the deposits of British Columbia.

New Zealand.—Early in the present year accounts reached this country

of gold discoveries having been made in New Zealand, and although, so far as I am aware, no very detailed reports of the method of its occurrence have been yet received, there is every reason to believe that remunerative deposits of the precious metal have been found in this colony. A letter published in the *Daily Telegraph* in March last states :—

"The great influx of gold into Dunedin from the Otago gold fields still continues. On November 22nd and 28th, and on December 15th last, the escorts conveyed respectively 21,000 15,000, and 14,000 ozs. The total number of gold brought down by escort up to December 20th, is 191,831 ozs., which, at 3*l*. 17*s*. per oz., is of the value of about 738,550*l*. This is independent of what has arrived here through private hands. New diggings are continually being discovered in the locality." It also goes on to say that, "It will not be long before New Zealand will be recognised as a gold-bearing country, for it is known that the whole of its mountain ranges are auriferous, from the south to the extreme point of the north." The *Otago Daily Times*, of February 17th, has the following remarks on the rapid process of that settlement, consequent upon the discovery of gold fields in the immediate vicinity :—"The population of Otago is on the increase, and the gold fields continue to prove very productive to the number of miners engaged in working them. Every day tends to prove that gold exists in paying quantities over a large portion of the province, and that gold mining will continue to form a profitable pursuit to a large population for many years to come. The most noticeable event during the last month has been the discovery of a new gold field on the Lammerlaw Creek, near its junction with the Waipori. Opinions respecting it are more or less conflicting, but the general belief is that it will prove a valuable addition to the already-opened gold fields."

I am not in possession, however, of any special information relative to this colony, and shall, consequently, pass on to notice the gold fields of Nova Scotia, which I have recently visited and with which I am, therefore, better acquainted.

Nova Scotia.—As the portion of Mr. Phillips' paper on the gold fields of Nova Scotia has, in substance, already appeared in the *Magazine* for February last (p. 81), we think it unnecessary to reprint it here. Mr. Phillips adds, however, the following concluding remarks :—

It would be impossible to form any reliable estimate of the total amount of gold which has hitherto resulted from mining operations in Nova Scotia, as the claims are for the most part worked by private individuals, who are generally indisposed to furnish information either as to their success or failure, and no official returns on the subject have as yet appeared. It is manifest, however, from the characteristics of the localities in which the precious metal has already been discovered, and the great extent of the gold-bearing portions of the province, that there is every reason to anticipate that further and more important results will be developed by the workings and explorations of the present summer, and that ere long Nova Scotia will take an important position among gold-producing countries. The thickness of its auriferous veins is, perhaps, less than those of California and some other countries, but they are, generally speaking, richer in visible gold than the average of those I have seen in any other part of the world. It must also be taken into consideration that Nova Scotia possesses many decided advantages over both California and Australia. Each of these countries is situated at a great distance from Europe, and can only be reached after a long and expensive passage, and, as a natural consequence, wages were for a long time exceedingly high and provisions proportionately dear. Nova Scotia, on the contrary, is within an easy distance both from Europe and the United States of America, and possesses a considerable settled population of intelligent industrious, and sober people, eminently adapted, after a little experience,

to become steady and efficient miners. The whole of the gold-bearing portion of the province also lies within a convenient distance from the coast, which abounds with magnificent harbours, affording ample security to shipping, whilst wood in large quantities is to be everywhere procured for all descriptions of mining uses, and an abundant supply of water is generally to be met with for the purposes of washing and amalgamation. From these circumstances, it is impossible that wages can ever reach the extravagant rates that mainly led to the failure of nearly all the gold mining enterprises of 1852, since which period many of the mines have been advantageously worked which were then abandoned on account of the enormous expenditure necessary to carry on the operations.

Gold of North Wales.—The gold district of North Wales would appear to be chiefly confined to an area of about twenty square miles, lying on the north of the turnpike road leading from Dolgelly to Barmouth. In this region the Cambrian rocks are overlaid by the Silurian, and the general geological features of the country strongly resemble those of other auriferous localities. The most important discoveries have been made in the Dol-y-frwgnog, Prince of Wales, and the Clogau mines, of which the latter only is at the present time worked with remunerative results. So long ago as 1884 a paper was read before the British Association by Mr. Arthur Dean, who stated that a complete system of auriferous veins exist throughout the whole of the Snowdonian or Lower Silurian formation of North Wales. In consequence of this statement, operations were commenced at Cwmhesian, but, the results obtained not having been found satisfactory, they were finally abandoned. Ten years subsequent to this time the mine was again worked for gold, but still with unfavourable results. Machinery for crushing and amalgamation was about two years afterwards erected at Dol-y-frwgnog, but, after operating on several hundred tons of quartz, the result was in this instance also a failure. Of all the auriferous veins in the neighbourhood of Dolgelly that at present worked in the Clogau Mountain is certainly the most important. This mine is situated at a height of about a thousand feet from the level of the sea, and the workings are extended on what is called the St. David's or Gold lode. This lode, which is almost perpendicular, runs nearly east and west, and is chiefly composed of auriferous quartz, more or less impregnated with sulphides of iron, lead, and copper. The veinstone also exhibits large quantities of disseminated gold, which generally occurs in a state of minute division. This mine is, being worked on a small scale, and by means of very simple and far from perfect machinery. The following returns were, however, made during the course of the year 1861:—Ore crushed, 456 tons 32 lbs.; fine gold obtained, 2,884 ozs. 1 dwt. 7 grs., being at the rate of 6¾ ozs. per ton of quartz operated on. During the current year, up to April 26th, the results have been—Ore crushed, 255 tons 16 cwts. 16 lbs.; fine gold obtained, 1,962 ozs. 2 dwts., or 7⅝ ozs. per ton of quartz. It is needless to add that such a degree of success has given rise to the commencement of numerous mining operations in various parts of the district; but if gold mining in Merionethshire be approached in the speculative spirit that characterized the proceedings of 1852, it requires no prophet to foretel that numerous failures must necessarily be the result.

Methods for Extracting Gold from its Matrix.—The most simple and, at the same time, most ancient method for obtaining gold is undoubtedly by washing the sands and dirt with which it is found associated. Among the earlier miners in California and Australia the "cradle" was much employed. This instrument appears to have been introduced from Virginia and Carolina, and consists of an oblong inclined box, having a sieve at its upper extremity mounted on rockers, so that, by means of a handle, it may be swayed from side to side. The interior of this case is provided with a sloping diaphram of tightly stretched canvas, and the bottom is divided

into partitions by means of wooden cleets. Washing by the cradle is, however, a very slow operation, and requires a great deal of manual labour, since, besides rocking, it is necessary to supply it with water by means of a dipper, and to continually stir the fresh-brought stuff deposited on the sieve. The gold and other heavy bodies retained between these wooden divisions are finally re-washed in a tin pan, and the metal thus obtained in a pure state. The loss of fine gold attending this operation is very great.

The arrangement which next came into general use among Californian miners was the "long tom." This consists of a long, roughly made wooden case, having a considerable inclination, and provided at its lower extremity with a sieve made of perforated sheet iron, beneath which is placed a "riffle-box," divided into compartments, as in the case of the cradle, by means of slips of wood. In the upper trough a stream of water is so directed as to fall with considerable force upon the auriferous drift with which it is charged, and this being continually stirred with a shovel, the finer particles are gradually washed through the sieve over the riffle-box, whilst the coarser fragments are from time to time removed, after being duly examined for any nuggets they may contain. The stuff retained by the riffles is afterwards washed in a pan, and the clean gold is thus separated. The tom has the advantage over the cradle of getting through a much larger amount of work within a given time; but it requires a much more plentiful supply of water, and the loss of fine gold is great.

When convenience exists for its introduction, the "sluice" has now generally superseded the tom. This arrangement is nothing more than a long run of wooden troughs, provided with false bottoms, in which auger-holes have been bored to a certain depth, and in which mercury is generally placed. Through these inclined troughs the "pay dirt" is washed, and the metal, from its greater density, settling in the depressions at the bottom, and combining with the mercury placed there for that purpose, is thus retained. These false bottoms are occasionally removed, and the mercury separated from the gold by filtration and subsequent distillation. This process, although a certain portion of the gold is still lost, is generally much preferred to either of those above described. It is also now customary, whenever a sufficient fall of water can be obtained, to direct a stream, by means either of metallic tubes or canvas hose, against the bench of pay dirt it is intended to remove. A powerful stream playing against the side of a hill will in a short time disintegrate a large quantity of dirt. The rubbish thus detached is conducted through a sluice in the usual way, and the gold is in this manner separated and collected. This method of proceeding is known by the name of "hydraulic mining," and is, generally speaking, considered the most economical that can be adopted. When, instead of being found in deposits of pay dirt, the gold occurs in veins, associated with other metals, it becomes necessary to reduce the gangue to a state of fine division before it can be extracted. Two distinct methods are employed for the separation of this metal from from the matrix with which it is associated—viz., washing and amalgamation.

In some countries, and particularly in Mexico, the "arrastre" is much employed for the treatment of auriferous minerals.* This consists of a vertical axis, provided with cross arms, to which are attached, by means either of ropes or thongs of untanned leather, two or more heavy masses of porphyry. Mules are harnessed to one of the projecting arms, and a rotatory motion given to the shaft. The stones thus set in motion are dragged over a well-paved bed, and thus, by an action somewhat resembling that of the common muller and slab, the ore is gradually

* For a drawing of an arrastre, see Mr. Napier's paper in March Number, p. 168.

reduced. Mercury and water are added to the ores operated on, and the resulting amalgam is from time to time passed to the retort. In some instances the ores are introduced into the arrastre in fragments of about the size of peas ; but in large establishments it is first coarsely ground in a stamping mill. It is needless to say that grinding by means of the arrastre is a slow and expensive operation.

In Chilli the "trapiche" is much used. This is nothing more than a grinding-mill, like the ordinary edge runner. The roller runs on a groved bed-stone, in which a certain quantity of mercury is placed, and by the continual trituration of the revolving runner the ore is gradually reduced and amalgamation effected. This is however, like the foregoing, a tedious and costly operation.

In some cases a mill like that commonly employed for grinding corn has been made use of, and found to answer remarkably well. In one establishment where apparatus of both constructions is in operation the ratio of the cost of grinding by the horizontal mill as compared to the edge runners is as 2*s.* 3*d.* to 6*s.* 10*d.* The ordinary roller crushing-mill has also been employed for the reduction of gold quartz previous to amalgamation, but it cannot be considered to be well adapted for this purpose. In the first place, the whole of the stuff coming from the mill has to be passed through sieves of fine wire-gauze, and these become so rapidly worn by the rougher fragments which are being returned to the raff wheel so as to render repairs constantly necessary, and the operation very expensive. Then, again, unless the ore be remarkably dry these sieves choke, and the stuff is carried round and round without passing through ; and, finally, if the ore be dry, such a dust is created as to nearly choke those attending to the crusher.

Among the quartz miners of California and Australia the stamping-mill is now the machine almost universally employed. The ore is often first calcined in heaps of kilns, and, after stamping, the reduced mineral is passed through apparatus of various forms for the separation of the gold. The calcination of the quartz, although not always adopted, is frequently productive of advantageous results. Hard quartz is rendered much more friable by this treatment, and when a large proportion of sulphides is present the expulsion of sulphur by the operation of roasting is likewise beneficial. It is also probable that when gold occurs in thin finely-divided laminæ the ignition of the quartz causes such an agglutination of its particles as to cause them to offer less surface to the action of the water, and that the loss of "float gold" is thereby diminished.

The metal is separated from the stamped ore either by washing alone, or by washing and amalgamation. When the former process is resorted to the stuff flowing from the stamping-mill is either allowed to pass over riffle-boxes, or is conducted over blankets, or skins on which the air is retained. These are occasionally washed in proper vessels, and the metal retained by them thus collected. The gold so obtained is, in most instances, concentrated by washing in a "batea" or otherwise, and finally amalgamated, or less, frequently fused with litharge, or an ore of lead, and finally cupelled. When amalgamation is employed, the riffle-boxes may be charged with mercury, or the auriferous sands produced can be passed through triturating apparatus containing mercury, with which the gold is caused to combine. In some cases barrel amalgamation is resorted to. The diagram on the wall exhibits a combination of three of the most efficient amalgamating appliances used by the miners of California and Australia, which is well calculated to separate the precious metal from ordinary gold quartz. The ore flowing from the mill, first passes over a lip through a triturator, not unlike that employed at Zell, in the Tyrol, and then falls into an appartus the action of which is similar to that of the amalgamating barrel. Finally, the whole of the stuff, before passing over riffle-boxes or blankets, is

agitated in a column of mercury, through which it is made to descend. In some instances, where water is not plentiful, that from which the tailings have settled is again pumped round. In this case a little wood ashes should from time to time be thrown into the mill. This is employed for the purpose of saponifying any oil or other fatty matter which, if present in *even the most minute proportions*, when quicksilver is used, would, by preventing the particles of gold from uniting with the mercury, materially interfere with the results obtained. It is, therefore, of great importance in all quartz crushing and amalgamating establishments that proper care be taken to prevent any dropping of oil from the bearings into the apparatus, since the result of such an accident would inevitably be a notable falling off in the the produce of gold obtained. In order to prevent loss occurring through this cause it would, as before stated, be found advantageous to throw from time to time into the mill a little wood ashes, or some other alkaline body, for the purpose of removing any greasy matter which may have become accidently introduced. When the quartz contains an appreciable quantity of auriferous sulphides it would in many cases be found advantageous to separate these from the tailings by means of a Hundt's buddle applied to the end of the riffles. The sulphides thus collected might be treated either by fusion with oxide of lead, and the produce cupelled for gold, or after a preliminary roasting be again subjected to amalgamation. The former process will, however, in many instances prove the most advantageous.

As an instance of the small yield of gold which, even in Australia, is at the present time found remunerative, I would quote the following results of the Colonial and Port Philip Company. It must, however, be observed that, to obtain a satisfactory profit from ores of this class, it is necessary not only that large quantities should be treated, but also that the greatest economy should be observed in every department of the manipulation The quantity of quartz crushed by this company between October 1st, 1860, and September 30th, 1861, was 32,258 tons, from which the produce was 24,336 ozs. 6 dwts., being an average of 15·2 dwts. per ton. The quantity crushed during the preceding year was 21,693 tons, and the produce 17,466 ozs., being an average of 16 dwts. per ton, showing an increase in crushing of 10,563 tons, and on yield of gold of 6,870 ozs. over the same period of the previous year. It will be perceived that the yield of gold per ton had experienced a variation of 22 grs., equal to 5¾ per cent. The total expenditure per ton has been 12*s.*; in the preceding year it was 16*s.* The profit on the quartz crushing for the year ending September 30th was 22,958*l.* 16*s.* 5*d.*

Assay of Ores containing Gold.—Minerals containing gold are in most instances assayed in precisely the same way as those affording silver. It may be proper to remark here that although nothing is more easy than to estimate with great accuracy the amount of gold contained in any given specimen of gold quartz, it is considerably more difficult to obtain a fair average sample of the usual produce of a vein. When the metal is in a fine state of division, and equally disseminated throughout the gangue, this presents less difficulty; but when, on the contrary, it occurs in pockets and irregular deposits it frequently requires the exercise of great care in order to avoid falling into very serious errors. It is consequently of the highest importance that whenever ores are to be assayed for gold the greatest care should be observed in preparing the samples on which the operation is to be conducted, of which at least six different assays of 1,000 grains each should be made.

If after accurately testing the produce of a parcel of ore, it be passed through the most efficient crushing and amalgamating machinery with which we are acquainted, it will be found that the total amount of gold originally present in the stuff is never obtained, and if this deficit be

sought for in the tailings resulting from the operation it will be discovered that a certain small quantity of the precious metal still remains unaccounted for. This deficiency would appear to be due to the circumstance of minute particles of flattened gold having floated off on the surface of the water, and frequently amounts to nearly 2 dwts. per ton of ore treated. When the ore to be examined contains silver in addition to gold, and it is desirable to ascertain its amount, it becomes necessary first to cupel the button of lead without the addition of silver; the metallic globule thus obtained is weighed, and its weight noted, deductions being made for the weight of silver derived from the reduced litharge, which must be ascertained by a distinct cupellation. If more silver is required for the operation of parting it is added, and the button, together with the fragment of silver, enveloped in a piece of pure lead foil, and again cupelled. Lastly, the resulting globule is dissolved in nitric acid, and the gold weighed. The weight of silver present in the ore will consequently be represented by that of the button of alloy obtained from the first cupellation, less the united weights of the gold and the silver resulting from the reduced litharge. In concluding this subject I cannot better express the great importance of obtaining fair samples than by quoting the words made use of by Dr. Percy, in a lecture delivered in 1852, at the School of Mines, who, when speaking of good assays, said—"Above every thing be particular in obtaining an honest and fair sample. This is a matter of paramount importance, and of no small difficulty in many cases, but let there be honesty of intention, and this difficulty will be generally surmounted."

Gold Mining Speculations of 1852.—Shortly after the discovery of the gold deposits of California and Australia numerous associations were organized in the United Kingdom for the purpose of working gold mines in those countries, and I regret to say that, in almost every instance these have resulted in the loss of the capital so embarked, various circumstances have contributed to produce these disastrous results, but none more so than the fact that, in too many instances, sufficient attention had not been paid to obtaining samples, fairly representing the average produce of the various veins which it was intended to work. The specimens which reached this country were often picked samples, and on being placed in the hands of the assayer yielded a produce which was far from realized when fair average samples of the leads came to be tested on a large scale. Then, too, it was not unfrequently found that quartz veins, producing what should have been a remunerative amount of the precious metals, were situated in localities in which, either from the want of water or some other cause, their exploitation was attended with extraordinary difficulties. And, above all, the excessive price of labour, and all other mining requisites which then prevailed, was in most cases, a sufficient barrier to any thing like remunerative returns to the proprietary.

In all rich and newly-discovered gold districts, which have for the most part a very limited resident population, the alluvial and easily-worked deposits afford for a considerable time a superabundance of remunerative occupation for the newly-arrived immigrant, but as these gradually but slowly become exhausted, something more than mere muscular strength, becomes necessary in order to keep up the returns, a more systematic method of mining is adopted, a thorough combination of labour and the investment of larger capitals are required. It must, however, be remembered that these changes, although gradual even in a new colony, are infinitely more rapid than those who have always resided in European countries generally imagine. Ten years in the life of a colony, and particularly a gold-bearing one, effect greater changes in its commercial and social relations than a century in an old established country, and we have, consequently, no reason to be astonished that veins are at the present moment being advantageously worked both in Australia and California

when in 1852 such operations would have been attained by a certain and very considerable loss.

It is a generally admitted fact that veins of auriferous quartz have little or no relation, with regard to the expense of working them, with the more readily worked alluvial deposits in their vicinity. In the one case the rock has to be broken, crushed, and washed, at a considerable expenditure of time and money, whilst in the other Nature has for centuries been carrying on these operations, and so preparing the gold as to admit of its extraction by very simple means. It consequently follows that the period at which quartz veins can be advantageously worked in any given locality will not entirely depend on their yield, but will also be more or less influenced by the abundance and richness of the alluvial diggings in the vicinity, and the general price of labour, and materials in the district. The supply, and consequent price of labour must also be materially influenced by the distance at which gold producing countries may be situated from the great centres of civilization. From their remoteness and their consequent difficulty of access, Australia and California for a considerable period offered striking examples of the demand for labour exceeding the supply, but the constantly increasing facilities afforded for travelling, and in some instances their nearer proximity to Europe, will probably prevent this occurring to the same extent in the more recently discovered gold fields. There is, therefore, every reason to believe that the amount of gold annually derived from the working of gold quartz will go on gradually and rapidly increasing; and that, by the introduction of efficient and powerful machinery, ores of a very low produce will ultimately be treated with advantage. These observations particularly apply to the province of Nova Scotia, whose geographical position renders it impossible that labour should ever attain an excessive value, whilst, if a large supply of auriferous quartz can be obtained from the mines of North Wales, it is evident that a very small yield of gold, if continuous, might be rendered remunerative.

The operations of separating oxide of tin from its matrix, and gold from its ores, are, in many respects, exceedingly analogous, and, consequently, the expenses incurred in the one case may (all other circumstances being the same) serve approximately as a guide for estimating the cost which should be incident to the other. The most efficient apparatus employed in this country for the reduction of ores to the requisite degree of fineness are undoubtedly to be found in the tin mines of Cornwall; and as an example of the expense attending the process of stamping, it may be stated that at Polberro Consols, in the year 1854, a 36-in. condensing-engine, working at 55 horse-power, stamped no less than 30,200 tons of tinstuff, at a total expenditure of 1*s*. 3½*d*. per ton. Each head stamped, therefore, 420 tons per annum, or 28 cwts. per 24 hours, whilst the whole number reduced 100 tons per day, at a cost of 2*s*. 4*d*. per horse-power. During the same year the average produce of the stuff stamped was 20¾ lbs. per ton, and the net profit on the operations 2,350*l*. 9*s*. 8*d*. If we now assume the value of black tin to be 8*d*. per lb., and that the expense of stamping an equal quantity of gold quartz would have been the same, the total value of the produce obtained from each ton will be 13*s*. 10*d*., or equal to a yield of about 3½ dwts. of fine gold. It must, however, be admitted that the cost of stamping a ton of ordinary gold quartz will be somewhat greater than that of treating an equal quantity of Polberro tinstuff, and that when the gold is in an exceedingly minute state of division, or when sulphides are present in large quantities, the separation of the gold may sometimes be attended with a certain amount of difficulty, but this difference will, in many cases, not be material. It is, therefore, evident that when large quantities of auriferous quartz can be obtained, in a country where the price of labour is not high, it is not necessary that it should contain a large amount of the precious metal in order to render its treatment by the aid of well-construc-

ted machinery remunerative. As an instance of the very small yield which, under peculiar circumstances, may be rendered available, I would adduce the fact that at Schemnitz, in Hungary, in the year 1842, the total quantity of ores stamped was above 40,000 tons, and the average of the useful metals extracted from 50 tons was—gold, 3 ozs.; silver derived from the separating process, 3¾ lbs.; lead similarly obtained, 8½ cwts.; the ratio of the gold to the other materials being here as one to half-a-million. It is also important to state that in this instance the ores had to be broken from solid lodes, at depths extending to 200 fathoms from the surface.

The Chairman (Mr. Sopwith) in moving the vote of thanks, said that he was sure they would all agree with him as to the great value of Mr. Phillips's paper: he had seldom listened to a paper in which a subject has been more clearly brought forward. For his own part, he considered that the real interest of the subject rested upon the extraction of the gold, which occurred in a state of very minute subdivision, since it was there that we must look for profits. Many of the remarks in Mr. Phillips's paper must be of the greatest possible use both to those supplying funds for the working of gold properties, and to the gold-seekers themselves. He considered that Mr. Phillips had laid the Society under a great obligation to him, and he, therefore, asked them to give him their best thanks. With respect to the peculiar contorted formation referred to by Mr. Phillips, he thought it was highly interesting, and he would, in connection with it remark that in the International Exhibition, in the Belgium department, they would find maps of formations met with in that country where the contortions were even still more remarkable. Mr. Phillips had told them that in a new colony the change effected in ten years was as great as a century would produce in an old country—a statement which he entirely agreed with. To confirm it they need only refer to Australia—the colony of Victoria. In the course of the ten years, since the first nugget was brought over, the improvement had been marvellous. In 1851 the export of gold was 145,146 ozs., the value of which was 580,527*l.*; whilst in 1860 it was 2,156,660 ozs., worth 8,626,642*l.*; the aggregate in the ten years being nearly 24,000,000 ozs., of the value of 95,671,918*l.* This was according to the Customs' returns, but if they added the amount brought over privately, the value would be raised to the enormous amount of 103,971,976*l.*

MINERS' PERMANENT RELIEF FUND.

Since we referred to this subject last month, the decision of the Northern Coal Trade has been received by Miner's Delegates of Northumberland and Durham. This decision, which was communicated by the letter of Mr. Thomas Doubleday, the Secretary, was unfavourable to the scheme suggested—to which seemingly insuperable difficulties were pointed out. All the Committee could suggest, was "a fund in aid"—a proposition, it must be confessed, of rather an indefinite nature. It is much to be regretted that some system of co-operation between masters and men could not be brought about, for its absence leaves room for an agitation which will probably lead to bad feelings on both sides. Among the men, one party seems favourable to a course of independent local action on their own part; but another party seem desirous of acting with the "National Association." If the reports given are correct, the representative of this association, Mr. Towers, who has been located in the Newcastle District, seems to have shown more zeal than discretion. It certainly cannot be the object of some at least of the Committee of this Association to employ funds subscribed for benevolent purposes in a systematic propagation of discord and bad blood between employers and employed: the matter should be approached in no such feeling, for what are the interests of the one are substantially the interests of the other. If the masters looked at

the matter in a purely selfish light, and one merely antagonistic to the workman, they would probably wish for nothing better than such an imprudent and chimerical agitation as Mr. Towers is now engaged in—which, at the best, can only end ridiculously. A national relief fund—embracing the whole kingdom—is evidently beyond the grasp of any organization less than a government department; and we doubt much whether it is a task any government would relish to undertake. If the trustees of this Association, in its present condition, venture to receive the contributions of workmen, on the representation of giving adequate relief in return, all we can say is that they are extremely bold men, and are placing themselves in a position which we fear they will some day find far from agreeable. The funds of working men are not to be trifled with.

While this unprofitable agitation is going on in the North, a meeting of the West Yorkshire coal owners was held at Leeds on the 17th May, at which a very instructive discussion took place. The following preliminary resolutions being passed, a committee was appointed, and the meeting adjourned for a fortnight:—

"That a district association be established, for forming a fund for the support of widows and orphans of miners and others persons who are accidently killed in the prosecution of their labours, at the collieries on the north side of the Lancashire and Yorkshire Railway."

"That the proposed association be styled the West Yorkshire Northern Association, for providing a miners' widows and orphans' fund, the object of which shall be to assist and encourage the miners in raising such a fund."

THE GEOLOGICAL JOURNAL.

The Quarterly Journal of the Geological Society. Edited by the Assistant-Secretary of the Geological Society. No. 70, vol. xviii, part 2. London: Longmans.

THIS number of the *Quarterly Journal* contains matter of particular interest, among which we may specially mention the anniversary address by Professor Huxley, and the paper of our esteemed contributor, Mr. Edward Hull, "On the Distribution of the Carboniferous Strata in Great Britain."

Professor Huxley's address, in clearness of thought and vigour of style, is one of his happiest efforts. The greater part of it bears on matters purely biological, and consequently beyond the scope of our *Magazine*, but a portion of it is devoted to a discussion on the real meaning of the word "contemporaneous," as employed by geologists—a question capable of becoming one of economic importance, particularly in connection with coal deposits. Professor Huxley considers, as many physical geologists have already considered, that Palæontologists have pushed the doctrines of synchronism too far, in dealing with large areas or with completely separated deposits. All that can fairly be said of such deposits—such, for instance, as the lias of England and the lias of Germany—is that they are within the same great epoch; but whether this "great epoch" means a hundred years or a thousand, or a million, or ten million years, the answer of the thoughtful geologist is—I cannot tell.

Mr. Hull's paper, which may to some extent be considered a continuation of the same subject as that treated of in his memoir "On the South-easterly Attenuation of the Lower Secondary Rocks," in the xvi. vol. of the *Quarterly Journal*, is one of the highest economic importance with regard to the probable extent of the carboniferous strata lying under the secondary deposits in Great Britain. We shall give a full abstract of this paper in our next number; but in the meantime we recommend our readers

ested in this matter to refer to the paper itself in the *Quarterly* *rnal.*

he Miscellaneous division contains two lithological abstracts (with the ...-known initials H. C. S.) from M. Delesse's memoir "On the Azote and ...anic Matters in the Crust of the Globe," and from Professor Bunsen's moir "On the Formation of Granite."

Correspondence.

[We need scarcely say that we cannot hold ourselves responsible for the facts or opinions of our correspondents; although we shall make it a point to endeavour to exclude those who are obviously inaccurate or fallacious, as far as is consistent with our wish to encourage the freest discussion.]

CAPTAIN W. VIVIAN ON PRACTICAL MINING.

Dear Sir,—The remarks of Capt. Vivian, in your last Magazine, are I think judicious for the most part. He says truly that the character of the ground, whether on the lode or in a cross-cut, should determine the size of the level; but if the level is to be driven a long way without shaft or winze to ventilate, then for the sake of ventilation the level should be larger than would be required for driving economically only. These principles are recognised and acted upon very generally in the Cornish mines of note, the size of the levels being fixed by the agents on setting the bargain. The men will sometimes, towards the close of the month, contract this size just to get the line of measurement as long as possible, but that is counteracted by the agent.

In this mine, the general size of levels is 8 feet by 6 feet, but sometimes, when the nature of the ground or other circumstances require it, the size is higher or wider, sometimes 7, 8, or 9 feet in width, and sometimes 9 feet high. The object ever kept in view is, *in hard ground*, to *open the mine as fast as possible*, and if Capt. Vivian has not seen our hard ground Cornish mines for the past 10 or 12 years, he cannot form a correct opinion or notion of what is being done in such mines. However, he is worthy of thanks for directing attention to this or any practical question in mining.

Dear Sir, Yours truly,

Dolcoath Mine, Camborne, Charles Thomas.

May 20th, 1862.

Sir,—There occurs two misprints in my letter on "Practical Mining," at page 333, 12th and 16th lines, "clearage" being twice printed for "cleavage."

Pary's Mines, near Bangor, W. Vivian.

May 7th, 1862.

MEXICAN METHOD OF AMALGAMATION.

Sir,—Perhaps you will be kind enough to allow me to correct a few errors which occurred in my papers on the above subject.

Page 172, 7th line from top, for "Are finely ground" read "Ore finely ground," and leave out the hyphens.

Page 172, 4th line from bottom, for "*Asogerros*" read "*Asogueros*."

Page 174, 12th and 20th lines from top, for "*Dolares*" read "*Dolores.*"
Page 231, 10th line from top, for "Fine Amalgam" read "Zinc Amalgam."
Page 233, 5th line from top, after "this" insert "the."
Page 234, 4th line from bottom, for "Saco" read "Tasco."
Page 235, 10th line from top, for "Ensabmorar" read "Ensalmorar."
Page 236, 10th and 29th lines from top, for "Incorparo" read "Incorporo."
Page 238, 26th line from top, for "Where" read "When."

I am, &c.,

JAMES NAPIER, Jun.

[We have received several communications on Captain Vivian's letter, and on other matters, for which we cannot find space this month.]—ED.

Notes and Queries.

THE subject of Furnace *versus* Machine Ventilation has been the topic of discussion amongst scientific men for the past few years, and there are great differences of opinion as to the merits of the rival modes of ventilation. Struve's ventilating machine, which, for ingenuity and skill of construction, redounds to the credit of the inventor, has been adopted in several collieries in the South Wales district, and no fault has been found with its working. At the great Risca inquest, the ventilating machine was the especial subject of attention, and the evidence conclusively proved that it had always worked with the greatest regularity; Mr. Brough, the Government inspector, and several of the mining engineers present, however, gave a decided preference to the furnace for safety and regularity. The limit of the machine was looked upon as objectionable, while, on the other hand, a furnace could be made to draw an unlimited quantity of air. A machine is also liable to breakage, and the natural ventilation that would ensue would be nothing compared with the natural ventilation after a furnace had been put out. The machines at the different collieries have not, it is true, shown any of these defects, but there is a probability that they might do so. Influenced by these considerations, and by the strong recommendation of Mr. Brough, the Government inspector, the managers of the Risca collieries have determined on substituting a furnace for the ventilating machine. This, it is believed, will conduce to the safety of both men and property; and as the black vein is an exceedingly fiery one, it is only proper that every reasonable precaution should be taken against accidents.

We have received a lengthy communication from Mr. John D. Nash, of Variety Hall, Halifax, Nova Scotia, on the mineral resources of that province; but we have not space at present to enter upon the wide field of subjects Mr. Nash refers to.

THE HARTLEY CATASTROPHE AND BRATTICED SHAFTS.—A parliamentary paper has been issued during the month, containing Mr. Kenyon Blackwell's report on the Hartley accident, and also "copies of the replies of the inspectors of mines to the circular letter which was addressed to them, by desire of the Secretary of State for the Home Department, on the subject of shafts." Mr. Blackwell's report is able, suggestive, and moderate, as we might expect from a gentleman of his position. While dwelling upon the immediate causes of the unhappy disaster in question, he avoids that dogmatising of which we have recently heard so much, but which is really only worthy of "sensation" article writers in newspapers, manufacturers of "padding" for popular magazines, trading philanthropists, or fourth-rate

M.P.'s in search of some topic by which they may gain a nine days' notoriety.

The reports and recommendations of the inspectors, which are singularly unanimous, contain many facts and suggestions well worthy of consideration. A little less unanimity—as evidencing a greater amount of independent opinion — would have been perhaps preferable, particularly as the reports were made during a time of popular clamour. We do not say they were influenced by this clamour ; but we know how different it is to avoid being affected by such a cry as resounded through England after the Hartley accident.

The following are the recommendations of Mr. Higson, which may be taken as representing the views of nearly the whole of the inspectors :—

1. That the 6th General Rule be so amended as to compel every future working and pumping pit or shaft to be securely cased or lined throughout with iron, brick, or stone.

2. That on and after the 1st January, 1863, proper guides or conductors shall be provided, and used in every pit or shaft in which persons ascend or descend ; and that at every working pit or shaft there shall be movable or self-adjusting guards or gates to fence off the entrance thereto.

3. That from the workings of every mine there shall be two distinct shafts or outlets, not less than ten yards apart.

4. That mines now opened and being worked with a single bratticed shaft, may be continued for three years, if during that period active operations are in progress to provide a second outlet, and the means of egress therefrom.

5. That for the purpose of exploring or proving the ground, a single bratticed shaft may be used for a period of six months after finding the vein or seam, provided that not more than ten persons shall be in the pit at the same time.

6. That when water has to be pumped in a single bratticed shaft, proper and satisfactory preparations shall be previously made to prevent detached portions of the machinery or other apparatus, in case of breakage, falling into the pit or shaft.

7. That during the time persons employed in working any mine are ascending or descending the pit or shaft, pumping in that pit or shaft shall be suspended.

Mr. Kenyon Blackwell, in his report, points out that all the pumps in the Hartley pit were bucket lifts ; and he justly remarks that the use of such lifts are "a source of much danger" when employed exclusively to considerable depths, in connection with powerful engines. We may add that their employment to such an extent is most wasteful, and is indeed an engineering barbarism. If the metallic mines of Cornwall are behindhand in their appliances for raising their mineral produce, they certainly are infinitely in advance of colliery miners in pit-work. Such pit-work arrangements as were in use in the Hartley shaft, and which are largely adopted in still deeper and more extensive collieries, have been exploded in Cornwall for nearly fifty years.

Geological Society of London.—At the meeting of this society, on May 7th, the following papers were read :—

1. "Note respecting the discovery of a new and large Labyrinthodont (*Loxomma Allmani*, Huxley) in the Gilmerton ironstone of the Edinburgh coal-field." By Professor T. H. Huxley, F.R.S., Sec.G.S.

2. "Note on a new Labyrinthodont (*Pholidogaster pisciformis*, Huxley) from the Edinburgh coal-field." By Professor T. H. Huxley, F.R.S., Sec.G.S.

3. "On the Land Flora of the Devonian Period in North Eastern America." By J. W. Dawson, LL.D., F.G.S.

4. "On some Upper Eocene Fossils from the Isle of Wight." By Pro-

fessor Dr. F. Sandberger. In a letter to W. J. Hamilton, Esq., For. Sec. G.S.

At a meeting of the Society on the 21st May, the following papers were read:—

1. "On the Metamorphic Rocks of the Banffshire Coast, the Scarabins, and a portion of East Sutherland." By Professor R. Harkness, F.R.S., F.G.S.

2. "On the Geology of the Gold-fields of Nova Scotia." By the Rev. David Honeyman. (Communicated by the President.)

3. "On some Fossil Crustacea from the Coal Measures and Devonian Rocks of New Brunswick, Nova Scotia, and Cape Breton." By J. W. Salter, Esq., F.G.S., of the Geol. Surv. Great Britain.

4. "On some species of *Eurypterus* and Allied Forms." By J. W. Salter, Esq., F.G.S., &c.

5. "On *Peltocaris*, a new genus of Silurian Crustacea." By J. W. Salter, Esq., F.G.S., &c.

6. "On a Crustacean Track in the Llandeily Flags of Chirbury, Shropshire." By J. W. Salter, Esq., F.G.S., &c.

Mining, Quarrying, and Metallurgical Intelligence.

WALES AND THE BORDERS.

South Wales.—A decided improvement has been manifested in the shipping trade at the various ports during the month, and freights are a trifle tighter. Towards the middle of the month there was a much larger export of iron to foreign ports from Cardiff than for many weeks, if not months past. Almost every ton has been sent to the French, Spanish, and Italian ports, and the chief works in the interior of this district are still busily employed in executing orders which have been received for some time past, and which are almost daily arriving from the Continental ports. With respect to the coal trade there is still an absence of that activity which characterized it a few weeks since, although an improvement is visible. The Vale of Neath Railway Company has almost completed another coal drop in the Swansea South Docks, and there is every reason to believe that the temporary depression in the shipping trade will soon pass away. However, on the whole, considering the dull and unsatisfactory state of trade throughout the country generally, it is surprising that the Aberdare Valley, and the whole of the South Wales district, wears such a gratifying aspect, and that trade should be as buoyant and satisfactory as it is. Wales has not largely participated in the general depression of the country, and at the present time there are symptoms of increasing firmness on the part of ironmasters, and the orders which continue to arrive from the Continental marts will occupy the various works for some time to come. There are some rather heavy orders still on the books of the principal firms whilst the exports from Cardiff, and the other ports in the British Channel, continue large. The coal trade is not so brisk as during the past two or three weeks, there being but few ships of large tonnage for loading. The traffic returns upon the several railways connecting the ports with the collieries in the interior, show a considerable decrease in receipts, and we fear the returns for the month of May will fall far below that of the corresponding month last year.

Flintshire.—Under the title of the Leeswood Cannel and Gas Coal Company, a limited liability company, with a capital of 100,000*l*., in shares of 2*l*. each, has just been formed. The value of the collieries is so well known that the principal question remaining is the price at which they can

be purchased. The company has acquired the entire interest in the property, including plant, machinery, for 70,000*l*., of which 40,000*l*. will be in paid-up shares, and the remainder by periodical instalments. The collieries are at present in profitable operation, and considerable quantities of very superior Cannel (upwards of 2,500 tons per month) are being raised, and sold at prices which leave a good profit. The coal bears favourable comparison with that of both Torbane and Lesmahago, judging from the reports of Messrs. H. M'Culloch, M.E., T. M. D. Smith, R. D. Webster, and Prof. Fyfe. In this county a new company has been formed for the purpose of working the Gwern-y-mynydd and Cat Hole Mines, near Mold. The estimated capital is 10,000*l*., to be raised by 500 shares of 20*l*. each. Mr. A. T. Roberts, of Mold, is the Solicitor, and Mr. John Roberts, the Secretary *pro. tem*.

MIDLAND COUNTIES.

Derbyshire.—The iron trade of this district (says the *Colliery Guardian*) is in a very unsatisfactory position, and though at first some importance was attached to the greater introduction of iron in the navy, it is now thought that the trade will be confined to a few favoured houses. The inquiry for rails and machinery is increasing. The orders are chiefly for exportation. We have a better inquiry for plates, but the trade is very depressed, and there is great difficulty in obtaining remittances, whilst underselling is going on amongst the makers of inferior brands to a great extent. The coal trade is in a wretched condition, and in some districts there is little if any thing doing. Many of the coal-masters would gladly close their pits, so unremunerative is the trade, if it were not for the misery which it would entail on the workmen and their families. So long as the disastrous war with America continues, there is no hope for any improvement. The mineral products of Derbyshire are well represented at the International Exhibition. Mr. Barrow, of the Stavely Works, shows specimens of Derbyshire coal, ironstone, and iron. The Clay Cross Company exhibit similar productions. Messrs. Fowler and Co., of Sheepbridge Iron Works, show samples of iron from which the armour plates are made.

NORTHERN COUNTIES.

Northumberland and Durham.—The news of fresh Federal successes, brought by the last American mails, continue to impart greater confidence in the various departments of local trade—notably so in the iron manufacture. It is understood that American orders have been received in Staffordshire to a much larger extent than for some time previously, and if this favourable symptom of reviving commerce between the States and Great Britain continue, the Tyne and Wear will participate in the benefit conferred. Already the tone of the local iron market is firm; the furnaces and factories on the Tyne are improving; and in Cleveland, parties engaged in the production of iron, are actually busy. Concerning the coal trade there is scarcely any thing to be said. The steam and coking kinds are in tolerably good demand, but other sorts are in only very middling request, and none but the steam collieries are more than moderately busy. Chemicals have undergone no change for about a fortnight, and the trade is dull. Among last week's exports from the Tyne were 50,120 tons of coals, 2,089 tons of coke, 18,087 cwts. iron, and 5,988 cwts. of alkali, being an increase in the shipments of coals of 35,967 tons; coke, 350 tons; alkali, 3,445 cwts.; and a decrease in the shipments of iron of 2,692 cwts. The imports included cargoes of pit props from Drontheim, Libau, Dram, Gothenburg, Saltkallan, and Uddewalda; pyrites from Stavanger and Levanger: 2,210 bars of iron and 1,920 boxes of scrap iron from Gothenburg; a cargo of copper ore from Pomaron; and a cargo of sulphur ore from Rotterdam.

Metal Markets.

THE following weekly reports from Messrs. Von Dadelszen and North, show the position of the metal market during the month:—

April 30th.—There has been a slightly increased demand for metals since our last report, which for the present has arrested a further downward tendency.

COPPER.—The Indian orders for manufactured being still a shade below the price which manufacturers are willing to sell, it prevents any business of magnitude; orders could be placed at 10½*d.* per lb. The demand for raw is rather slack, at from 94*l.* to 95*l.* for tough cake and ingot. A fair amount of business has been done in Burra, from 94*l.* to 95*l.*; Kapunda, nom. 97*l.*; Chili, 87*l.* to 88*l.* in Liverpool.

TIN has not changed since our last report. English in fair demand at fixed prices. Straits has changed hands to some extent, at 113*l.* cash for home consumption and export. Banca, nothing doing, price quite nom., 124*l.* The Dutch market is flat at 72f. 140,000 slabs arrived towards next annual sale.

TIN PLATES in moderate demand. Some second-hand lots coke have been sold in Liverpool at very low prices. Charcoal move off slowly.

In LEAD there has been more doing, a good deal having been shipped for American orders: prices slightly firmer.

May 7th.—The slight improvement in the metal market which we noticed in our last report has been fairly maintained; still business is much restricted. The moderate prices at which copper, tin, and spelter are now obtainable have as yet not attracted the attention of operators.

IRON.—Welsh bars are in fair request, at 5*l.* to 5*l.* 2*s.* 6*d.* f. o. b. in Wales, and at 5*l.* 17*s.* 6*d.*, delivered f. o. b. here. Good qualities of Staffordshire iron are selling to a fair extent. The fluctuations in Scotch pig iron have been without any material result; after advancing to 53*s.* 9*d.*, the price has dropped again to 53*s.* cash.

COPPER.—Not much business has been done. The limits or very best manufactured are a trifle below smelters' prices, which checks business. Tough cake and ingot 94*l.* to 95*l.* Some business has been done in Burra at 95*l.* Kapunda is held for 97*l.*, which effectually prevents business. Chili, 88*l.*, Liverpool.

TIN.—English unaltered, and in moderate demand. An average amount of business has been done in Straits, at 113*l.* cash, which is our present quotation. A few tons of Banca have changed hands at 122*l.* 10*s.* The Dutch market is dull at 71f. sellers.

TIN PLATES are in stock, but prices are unchanged.

LEAD is decidedly better; an advance of fully 10*s.* per ton having been established, and a large business has been done.

SPELTER.—Business has not been very brisk, but prices are well kept up. The last sales were 50 tons, ex ship here, at 18*l.* 5*s.*; and 50 tons 18*l.* 7*s.* 6*d.*, in warehouse, Hull.

May 14th.—There is a gradual and steady improvement in the metal market. A fair amount of business has been done, but prices have not undergone any change of importance since our last report.

IRON.—Welsh bars are in fair demand, at previous quotations, both f. o. b. Wales and here. Some good orders of Staffordshire here have been taken. Scotch pig iron has fluctuated to the extent of 6*s.* per ton; after touching 53*s.* 9*d.* cash, it has receded to 53*s.* 3*d.* cash.

COPPER quiet, but steady. Many orders for manufactured are below smelters' price, which prevents orders of magnitude. Tough cake and tile are slack. Foreign pretty steady. Burra 95*l.* Kapunda 97*l.* nom. Chili 97*l.* to 98*l.*

TIN in good demand for English, at fixed prices. Straits has sold freely at 113*l.* cash, at which price there are further buyers. Banca nominally 122*l.* The Dutch market dull at 70f. to 70½f.

TIN PLATES in better demand. Charcoal from 27*s.* to 28*s.*, according to quality, in Liverpool. Coke from 20*s.* 6*d.* to 22*s.*

LEAD continues firm, with a fair amount of business.

May 21*st.*—There has been a decided improvement in some branches of the metal trade, while in others, the demand has been very slack, with a drooping tendency in value.

IRON.—Welsh bars are steady and in ordinary demand, some makers ask 5*l.* 2*s.* 6*d.* f. o. b. Wales; but the current quotation is 5*l.* Bars f. o. b. here from 5*l.* 17*s.* 6*d.* to 6*l.* Staffordshire in fair request, at fixed quotations. Scotch pig iron has fluctuated to the extent of 6*d.* per ton; after touching 53*s.* 11*d.* cash, the price has given way to 53*s.* 7½*d.*

COPPER.—For English manufactured, smelters have at last submitted to 10¼, and they are now willing to book orders thereat. Tough cake and ingot at 93*l.* to 94*l.* Burra has been done at 94*l.* 10*s.* to 95*l.* which is the present value. Kapunda held for 96*l.*; Chili, 97*l.* to 98*l.*

TIN.—A good demand for refined and common. A large business has been done in straits, at 115*l.* cash and 115*l.* 10*s.* with full prompt—closing firm at these prices. Banca, 123*l.* nominal. The Dutch market has advanced to 71f.

TIN PLATES have sold to a very fair extent, and the market is stiffening.

LEAD.—A fair demand, and prices well supported.

SPELTER is very quiet; for parcels on the spot, 18*l.* 5*s.* is asked, but a trifle less would not be refused. Special brands in Hull realize 18*l.* 5*s.*, W. H. 18*l.* 15*s.*

Metallic-Ore Markets.

TIN.—The standard for black tin remains unaltered at—

Refined	£102—105
Common	101

There is, however, an improved demand for tin, and as stocks in the hands of consumers are very low, the least favourable turn must lead to an advance.

The West Briton has the following observations on the the position of the trade;—

The stocks of tin in England at the present time are larger than perhaps they ever were before; and this may partly be accounted for by the fact that the monthly produce of the Cornish is larger by 200 tons than usual. We have been accustomed to bring to market monthly from 900 to 1,000 tons, but of late the produce has been 1,200 tons. The present price of tin being lower than it has been for many years, consumers consider it a safe point, and orders are given out more freely.

COPPER.—At the four Cornish sales we give this month, the number of tons, average produce, quantity of fine copper, average price per ton, and standard, have been as follows:—

Date.	*Tons.*	*Produce.*	*Fine Copper.* Tons. cwt.	*Price per ton.*	*Standard.*
Apr. 24.	2,342	6⅛	142 2	£4 17 6	£125 16 0
May 1.	3,550	6⅜	226 12	5 4 0	124 8 0
„ 8.	2,876	6¾	192 9	5 11 0	124 2 0
„ 22.	5,647	6¼	350 10	4 17 0	122 13 0

At the sale of the 24th, according to the *Mining Journal*, there was a decline of 10*s*., while, according to the *West Briton*, there was an advance of 30*s*. At the sale of May 1st, the standard was stationary according to the *West Briton*, but advanced 15*s*. according to the *Mining Journal*. On May 8th it advanced from 20*s*. to 25*s*. At the sale of May 22nd there was a fall of from 3*l*. 10*s*. to 4*l*.

LEAD.—Comparing the lead-ore sales for the month with those of the former month, there appears to be no material alteration.

London Share-Market.

THE improved prospects of several mines has had a most wonderfully favourable effect on the market during the past month, and the amount of business transacted has certainly been the largest that we have had the pleasure of noticing during the last twelve months.

East Caradon, after many fluctuations, closed at 44¾, 5¼; at one period these shares reached the quotation of 47 buyers, again receded to 42 sellers, but closed firm. The report of the mine last issued shows a little improvement on that of the previous week. The lode at the 70-fathom level will be reached, it is expected, early in July next.

East Carn Brea have advanced during the month, and were at one time quoted 20½, declined to 17, but again improved and closed at 19½. The reports on the position and prospects of this mine have been very conflicting for a long time past, and several agents have been commissioned to inspect the property. The results of these inspections are various, some highly favourable, others less so; but one conclusion seems to pervade all, viz.:—*that the mine is opening out well*, and that the reserves are rapidly increasing. The difference of opinion seems to be more immediately connected with the present market price of the shares, but the same opinions may as justly and do exist in regard to many other mines, some of which may be considered by a few to be selling at a very *low* figure, whilst other parties may be found who would as unhesitatingly pronounce the same property to be selling at rather a *high* rate. These contrary opinions arise from the difference in the amount of *perspective* value placed upon certain undertakings by various parties.

Clifford Amalgamated have been rather more dealt in, but closed lower.

East Grenville has advanced to 3 buyers, and the mine is said to be looking well.

Gonamena Shares have been inquired for, and some transactions have taken place.

Great South Tolgus largely dealt in at improved prices.

Great Fortune very steady and firm, and have been largely absorbed by investors. The mine is progressing very favourably.

Herodsfoot have risen to 41 buyers, and are generally scarce in the market.

Hingston Downs more inquiry at high prices.

Marke Valley have gradually receded to 9½ sellers.

New Seton much sought after, but very few shares came on the market. The mine is opening out well.

North Downs have been extensively dealt in at various prices, they closed lower.

North Trelawney have been subject to fluctuations, but closed firm at 28-30.

North Basset is again attracting attention. The sinking of Grace's shaft has been resumed, and the lode found to be worth, at present, 4 tons per fathom.

North Treskerby, numerous transactions at much advanced prices.

North Phœnix, several dealings at quotations varying between 7 and 9.

Providence, very firm and steady at former quotations.

South Carn Brea $3\frac{1}{2}$-4, with a fair demand.

South Caradon, very scarce in the market, the shares being taken for investment.

South Frances have risen considerably during the last few days, and closed 115-$17\frac{1}{2}$.

St. Ives Consols occasionally dealt in.

Stray Park shares have improved, and many shares have changed hands.

Tincroft has received considerable attention lately and closed firm at $11\frac{1}{2}$-12.

West Caradon, not very much business doing, they closed 34-36.

West Rose Down, very steady, 15-17.

Wheal Pollard have been quiet for some days past at 9*s*. to 10*s*.

Wheal Edward, only moderately dealt in at $1\frac{1}{4}$-$\frac{1}{2}$.

Wheal Harriett, steady 1-$\frac{1}{4}$.

Wheal Grenville have been largely dealt in, and advanced to $7\frac{1}{2}$. The reports from the mine are favourable at present.

Wheal Uny have been greatly in demand, and closed 9-$\frac{1}{2}$.

Wheal Ludcott, a very large amount of business has been done in these shares at various prices, they closed 9-$\frac{1}{4}$.

Wheal Margaret remain very quiet at 43-45.

Wheal Mary Ann were in demand at $15\frac{1}{2}$-16, but again receded.

Wheal Seton, a good business doing. The latest quotations will be found in the following closing list of prices.

Saturday, 31*st May*, 1862, 2 P.M.

The following are the closing prices furnished by Messrs. Webb and Geach :—

Camborne Vean, $1\frac{7}{8}$ to $2\frac{1}{8}$; Cook's Kitchen, 29 to 30 ; East Basset, 41 to 43 ; East Caradon, $44\frac{3}{4}$ to $45\frac{1}{4}$; East Carn Brea, $19\frac{1}{4}$ to $19\frac{3}{4}$; Gonamena, 1 to $1\frac{1}{2}$; Great Fortune, 25 to 26 ; Herodsfoot, 41 to 42 ; Hingston Down, 3 to $3\frac{1}{4}$; Marke Valley, $9\frac{1}{4}$ to $9\frac{1}{2}$; New Seton, 95 to 105 ; North Downs, $3\frac{3}{4}$ to 4 ; North Basset, $5\frac{1}{4}$ to $5\frac{1}{2}$; North Treskerby, $32\frac{1}{2}$ to $33\frac{1}{2}$; South Caradon, 340 to 345 ; South Frances, 110 to 115 ; Stray Park, 34 to 36 ; Tolvadden $2\frac{1}{2}$ to 3 ; West Caradon, 34 to 36 ; West Rose Down, 15 to 17 ; Wheal Clifford, 27 to 29 ; Wheal Grenville, $7\frac{1}{4}$ to $7\frac{1}{2}$; Wheal Ludcott, $8\frac{7}{8}$ to $9\frac{1}{8}$; Wheal Margaret, 42 to 44 ; Wheal Seton, 129 to 131 ; Wheal Uny, 9 to $9\frac{1}{2}$. East Caradon very strong, at an advance. Camborne Vean flat. Cook's Kitchen dull. Sellers of East Basset. East Carn Brea very strong. Grenvilles weaker in character. Ludcotts maintain their price.

South Frances in great request. Sellers of Pollards at 9/6. Gonemena quiet. Hingston Downs very firm. North Downs flat. Inquiries for North Basset.—*Foreign Mines*: St. John Del Rey, 58 to 60; United Mexican, $6\frac{3}{4}$ to $7\frac{1}{4}$; Great Northern 10/ to 12/; Port Phillip, $18\frac{1}{8}$ to $18\frac{1}{4}$; Santa Barbara, $\frac{5}{8}$ to $\frac{7}{8}$ prem.

Provincial Share Markets.

DUBLIN.—The following report is condensed from the *Mining Journal*:—Towards the end of April the general holidays allowed of no large amount of business. The few transactions which took place were chiefly in Mining Company of Ireland and Wicklow Copper shares; the former touched 17*l.* 10*s.*, but receded to 17*s.* 2*s.* 6*d.*, freely taken at 17*l.*; the Wicklow Copper Mining Company's shares moved back to 46*l.*, at which price they were in request. A few transactions took place in Carysfort shares, last call, or 20*s.* paid, at 19*s.*, or 5 per cent. discount. Connorree shares, were ineffectually offered at 32*s.* In General Mining Company for Ireland shares no business was noted. At the Wicklow Copper Mining Company ordinary half-yearly general meeting, on April 23rd, the directors' reports and accounts, made up to March 1st last, were laid before the shareholders.

In the beginning of May business in Mining shares was very brisk, except in Connorrees, which, therefore, fluctuated but slightly, and on sale at 32*s.* 6*d.* Great efforts were made to keep Carysfort shares in good odour pending the call of 5*s.*, payable on the 15th instant, and a kindly appearance in Ballintemple lead mine favoured the desire to keep them in good demand. Transactions, not officially noted, variously stated at 22*s.* to 24*s.* (20*s.* paid), but quotations ranged from 20*s.* to 22*s.*, sellers. Fully paid-up shares (50*s.*) changed hands at 35*s.* General Mining Company for Ireland shares improved; business was done at 4*l.* 12*s.* 6*d.* to 4*l.* 15*s.*, firm. Mining Company of Ireland shares were down to 16*l.* 10*s.*, but recovered, and left off at 17*l.* 2*s.* 6*d.* to 17*l.* 5*s.*, buyers. Wicklow Copper Company shares, 45*l.* 10*s.*, 45*l.* 15*s.* to 46*l.*

Further on in the month business not quite so brisk, but prices well sustained. Mining Company of Ireland shares ranged between 17*l.* and 17*l.* 5*s.*, and freely taken at 17*l.* 2*s.* 6*d.* Wicklow Copper shares firmer, and not to be had under 47*l.*, being an advance of fully 25*s.* per share on last price. Carysfort shares weak at 21*s.*, 20*s.* paid. Connorree shares receded to 31*s.*, and were on sale at that price. General Mining Company for Ireland shares rose gradually to 5*l.* 7*s.* 6*d.*, but flat.

Later in the month business rather slack. The greater portion of the few transactions which took place were done in Mining Company of Ireland shares, which remained in demand at last quotation, of 17*l.* 2*s.* 6*d.* to 17*l.* 5*s.* Wicklow Copper shares further advanced, from 47*l.* to 48*l.*, and in request. General Mining Company for Ireland shares from 5*l.* 7*s.* 6*d.*, flat, to 4*l.* 10*s.* Connorree shares on sale at 30*s.* 6*d.*, and Carysfoot weak at par (20*s.* paid).

Towards the end of the month in mines very little was done, nevertheless prices fluctuated but little. Mining Company of Ireland shares reached at one time 17*l.* 10*s.*, or 5*s.* advance on last price, but have receded to 17*l.* 5*s.*, firm, both for cash and for account. Wicklow Copper shares in demand at 47*l.* 10*s.* buyers, holding out for 48*l.* The recent American news would, no doubt, have caused an immediate improvement in these shares were it not for the temporary general dulness in our money market. Connorree shares have further declined, and on sale at 30*s.* Carysfort shares have changed hands at 20*s.* 6*d.*, and firm. General Mining Company for Ireland shares were freely offered at the recent reduction, but no transactions quoted.

Tabular Abstract of Mining Accounts for the Month.

Date of Meeting.	Name of Mine, and Number of Shares.	Balances.		Calls.		Dividends.	
		Debit.	Credit.	Per Share.	Total.	Per Share.	Total.
		£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
	CORNISH AND DEVON MINES.						
April 21	West Wheal Jane (10,000) ...	784 8 4	...	...	...	...	...
„ 22	New Birch Tor and Vitifer (6,000)	...	59 5 2	...	...	...	...
„ 23	Wheal Sidney (4,096)	2,060 6 8½	...	0 5 0	1,024 0 0	...	...
„ 25	West Condurrow (1,218) ...	...	165 0 4	...	...	...	...
„ 28	East Pool (128)	...	341 19 11	...	...	2 10 0	320 0 0
„ 29	Pendeen Consols (5,000) ...	...	836 19 5	...	...	...	...
„ 29	Wheal Arthur (5,990)	283 8 0	...	0 2 0	599 0 0	...	...
„ 30	South Condurrow (6,138) ...	34 16 9	...	0 2 0	613 16 0	...	...
„ 30	New Crow Hill (6,400)... ...	...	...	0 1 0	320 0 0	...	...
„ 30	South Caradon Whl. Hooper (4,096)	44 10 5	...	0 4 0	819 4 0	...	...
„ 30	Great Wheal Fortune (1,798) ...	...	1,571 3 11	...	...	0 10 0	899 0 0
„ 30	East Margaret (1,024)	785 0 0	...	0 15 0	768 0 0	...	...
May 2	Pedn-an-drea (8,465)	...	...	0 2 0	846 10 0	...	...
„ 5	South Frances (496)	...	2,562 4 11	...	...	1 0 0	496 0 0
„ 6	North Treskerby (848)... ...	95 3 4	...	...	...	...	...
„ 6	West Par Consols (25,000) ...	1,375 12 1	...	0 1 0	1,250 0 0	...	...
„ 6	East Grenville (6,000)	699 3 9	...	0 2 6	750 0 0	...	...
„ 6	Grambler and St. Aubyn (486)	358 16 4	...	1 0 0	486 0 0	...	...
„ 7	Gurlyn (4,910)	150 19 8	...	...	...	...	...
„ 8	Calvadnack (915)	891 0 0	...	1 0 0	915 0 0	...	...
„ 9	Cook's Kitchen (2,450)... ...	...	899 9 7	...	...	0 7 0	857 10 0
„ 9	Yarner (3,097)	668 2 8	...	...	...	...	...
„ 9	St. Day United (20,000) ...	12,007 0 0	...	0 8 0	8,000 0 0	...	...
„ 9	New Wheal Vaddon (2,500) ...	100 10 1	...	0 2 0	250 0 0	...	...
„ 9	West Tolvaddon (5,120) ...	...	...	0 3 0	768 0 0	...	...
„ 12	Rosewarne United (512) ...	1,318 11 0	...	2 11 6	1,318 8 0	...	...
„ 13	North Roskear (700)	162 7 7	...	...	...	...	...
„ 13	Unity Consols (6,000)	847 11 4	...	0 3 0	900 0 0	...	...
„ 13	North Phœnix (4,000)	...	151 13 9	0 3 0	600 0 0	...	...
„ 13	Frank Mills (5,000)	...	1,478 5 2	...	...	...	...
„ 14	North Downs (6,000)	...	1,464 0 0	...	...	0 2 6	750 0 0
„ 14	Garlidna United (1,024) ...	804 9 0	...	0 16 0	819 4 0	...	...
„ 14	Bampfylde (10,000)	...	203 12 5	...	...	...	...
„ 14	Wheal Sithney Carnmeal (2048)	2,127 11 4	...	1 0 10	2,133 6 8	...	...
„ 15	Devon Great Consols (1,024) ...	...	...	...	...	8 0 0	8,192 0 0
„ 15	East Rosewarne (5,000) ...	102 14 1	...	0 1 0	250 0 0	...	...
„ 16	Wheal Owles (80)	...	1,671 4 10	...	...	...	...
„ 19	North Buller (1,024)	201 0 1	...	0 10 0	512 0 0	...	...
„ 19	Great Caradon (4,096)	87 10 4	...	0 2 0	409 12 0	...	...
„ 19	West Damsel (256)	...	477 18 0	...	...	...	...
„ 19	South Crofty (1,105)	...	...	1 10 0	1,657 10 0	...	...
„ 19	Emily Henrietta (1,024) ...	...	...	0 10 0	512 0 0	...	...
„ 20	Wheal Trelawney (1,040) ...	...	1,990 18 10	...	...	0 12 6	600 0 0
„ 20	Wheal Buller (256)	...	789 13 11	...	...	...	...
„ 20	Wheal Grenville (5,844) ...	681 2 8	...	...	...	...	...
„ 20	St. Ives' Consols (940)	...	...	...	...	0 10 0	470 0 0
	WELSH MINES.						
April 26	South Minera (4,000)	...	...	0 10 0	2,000 0 0	...	...
„ 29	Brynford Hall (200)	8 6 1	...	1 0 0	200 0 0	...	...
„ 29	Herward United (200)	297 13 3	...	0 10 0	100 0 0	...	...
„ 29	Minera (1,800)	...	...	...	...	5 0 0	9,000 0 0
„ 30	Cwm-erfin (867)...	...	...	...	...	0 10 0	433 10 0
„ 30	Central Minera (2,500)... ...	...	...	0 2 0	250 0 0	...	...
May 5	North Hafod (6,000)	...	...	0 5 0	1,500 0 0	...	...
„ 6	Cefn Cilcen (2,500)	...	...	0 2 0	250 0 0	...	...
„ 16	Deep Level (2,000)	...	146 0 0	...	...	...	...

Prices Current of Metals.

From Messrs. JAMES and SHAKSPEARE'S, 10, Austin Friars, E.C.

		Per Ton.		
IRON	Bars .... in Wales ..	£5 0 0	@	£5 5 0
	„ .... „ Liverpool	....		5 15 0
	„ .... „ London	6 0 0	„	6 5 0
	Nail Rods .... „ Wales ..	5 12 6	„	5 15 0
	„ .... „ Liverpool	6 10 0	„	7 0 0
	„ .... „ London	6 15 0	„	7 0 0
	Hoops (Staffordshire) „ Liverpool	7 15 0	„	8 0 0
	„ „ „ London	8 5 0	„	8 10 0
	Sheets „ „ Liverpool	8 10 0	„	9 5 0
	„ „ „ London	9 0 0	„	9 10 0
	Bars „ „ Liverpool	6 15 0	„	7 0 0
	„ „ „ London	7 2 6	„	7 5 0
	Scotch Pig (No. 1. g.m.b.) the Clyde	2 14 0	„	2 15 0
	Rails .... in Wales	5 10 0	„	5 15 0
	Russian .... C.C.N.D.	....		....
	Swedish—Hammered—large sizes	....		11 0 0
	„ „ Indian sizes	11 5 0	„	11 10 0
STEEL	Hammered—faggot	....		16 0 0
	„ in kegs ¼ and ⅜ in...	....		15 0 0
COPPER	Australian and other *fine* Foreign	....		95 0 0
	Foreign Slab, for Prod. 96 per Cent.	....		84 0 0
	English Tile and Tough	92 0 0	„	93 0 0
	„ Best selected	95 0 0	„	96 0 0
		Per lb.		
	„ Sheets, Sheathing and Rod	10¼*d.*	„	10½*d.*
	„ Flat Bottoms	10¾*d.*	„	11*d.*
YELLOW METAL	Sheets, Sheathing and Rod	8¼*d.*	„	9*d.*
		Per Cwt.		
TIN English ..	Common Blocks and Ingots	....		114*s.*
	„ Bars (in barrels)	....		115*s.*
	Refined	....		119*s.*
Foreign ..	Straits	114*s.*		115*s.*
	Banca	....		120*s.*
		Per Box.		
TIN PLATES at Liverpool 6*d.* Less	Charcoal IC, best..........	28*s.*	„	29*s.*
	„ IX „	34*s.*	„	35*s.*
	Coke IC	21*s.* 6*d.*	„	23*s.* 6*d.*
	„ IX	27*s.* 6*d.*	„	29*s.* 6*d.*
		Per Ton.		
LEAD	Sheet	....		20 15 0
	Pig—W.B.	....		21 10 0
	„ Ordinary brands	....		20 15 0
	„ Foreign, soft..........	....		19 15 0
	Red	....		21 10 0
	Shot	....		22 10 0
	Dry White..........	....		27 0 0
SPELTER	(Cake)	18 0 0		18 5 0
ZINC	(Sheet)	....		23 10 0
		Per Bottle.		
QUICKSILVER	(in bottles containing 75lbs. each)	....		7 0 0
		Per Ton.		
REGULUS OF ANTIMONY, French	....	....		45 0 0

COPPER.—Yesterday Smelters reduced the previous nominal price of 11d. for ordinary sheets to 10½d., and other sorts in proportion, but export orders can still be executed at 10¼d.

YELLOW METAL continues unaltered, but we expect that this move in Copper will induce the makers who have been quoting 9d. to make some reduction.

LEAD is in very good demand, and quotations well supported.

Copper Ores.

Sampled April 9, and sold at Tabb's Hotel, Bedruth, April 24.

Mines.	Tons.	Purchasers.	Price. £	s.	d.
Great Wheal Busy	97	10	£3	3	6
	63	9	3	14	0
	59	11	2	4	0
	58	11	2	9	0
	55	9	2	14	0
	50	10	2	6	6
	40	8	3	12	0
	38	3, 8, 14	1	17	0
	26	11	1	7	0
	20	8	7	5	0
South Caradon	87	8	5	9	0
	85	4	5	8	0
	81	9	8	17	0
	69	2, 7	17	3	6
	46	8	8	15	0
	39	2, 3	19	3	6
	32	4	6	2	0
West Damsel	74	2, 7, 10	4	7	6
	63	3	2	15	6
	60	8	5	3	0
	57	3	1	7	0
	55	10	3	11	0
	44	4, 7, 10	5	1	6
Tywarnhaile	64	4	3	14	6
	51	14	2	11	6
	49	4	2	17	6
Tywarnhaile	48	14	£2	14	6
	38	4	2	9	0
Clifford Amalgam.	58	7	4	9	6
	56	8	4	5	0
	52	8	2	13	6
	26	8	2	1	0
	23	2	3	4	6
	20	2	0	15	0
Craddock Moor	49	2, 7	7	12	6
	47	2, 7	8	8	6
	35	2, 7	5	12	6
Wheal Polmear	50	6	3	16	6
	40	2, 7	4	10	6
	28	2, 3, 4	9	10	6
South Crinnis	49	6	3	10	6
	48	6	2	16	6
North Grambler	47	7	4	11	6
	43	3	5	14	6
Grambler and St. Abuyn	36	8	6	3	6
Cuddra	30	10	2	11	0
Wheal Damsel	30	9	4	15	6
Creegbrawse	10	6	3	0	0
	3	4	12	14	6
East Tolgus	12	8	3	8	6
New South Ellen	8	2	7	12	6
Wheal Kitty	4	2	7	6	6

TOTAL PRODUCE AND VALUE.

	Tons.	Amount. £	s.	d.
Great Wheal Busy	506	£1,472	2	6
South Caradon	439	4,180	12	0
West Damsel	353	1,308	1	6
Tywarnhaile	250	733	4	6
Clifford Amalgam	235	779	2	6
Carddock Moor	131	966	9	6
Wheal Polmear	118	638	19	0
South Crinnis	97	308	6	6
North Grambler	90	£461	4	0
Grambler and St. Aubyn	36	222	6	0
Cuddra	30	76	10	0
Wheal Damsel	20	95	10	0
Creegbrawse	13	68	3	0
East Tolgus	12	41	2	6
New South Ellen	8	61	0	0
Wheal Kitty	4	29	6	0

EACH COMPANY'S PURCHASE.

		Tons.	Amount. £	s.	d.
1	Mines Royal	—	——		
2	Vivian and Sons	228½	£1,916	9	7
3	Freeman and Co.	204¾	984	3	11
4	Grenfell and Sons	295	1,328	1	8
5	Crown Copper Co.	40½	159	14	3
6	Sims, Willyams & Co.	157	529	11	6
7	Williams, Foster & Co.	264¼	1,823	4	0
8	Mason and Elkington	447¾	2,191	17	8
9	Bankart and Sons	219	£1,193	19	0
10	Copper Miners' Co.	271½	878	6	6
11	Charles Lambert	143	307	0	0
12	Newton, Keates & Co.	—	——		
13	Alkali Co.	—	——		
14	Sweetland and Co.	111¾	284	5	8
	Total	2342	£11,436	19	6

Average Produce, 6½
Quantity of Fine Copper, 142 tons 2 cwt.

Average Standard £125 16 0
Average Price per ton £4 17 6

Copper Ores.

Sampled April 16, and sold at Tyack's Hotel, Camborne, May 1.

Mines.	Tons.	Purchasers.	Price.	Mines.	Tons.	Purchasers.	Price.
Clifford Amalgamated	101	4, 7	£5 5 0	Whl. Seton (Pendarves)	83	7	£4 15 0
	100	2	5 18 6		44	7	7 11 0
	95	8	5 5 0		13	4	14 9 0
	94	11	3 3 6	South Frances	66	9	5 13 6
	92	7	5 13 6		42	8, 11	3 7 6
	89	7	5 13 6		29	10	7 14 0
	70	3	5 6 0		28	8	6 6 6
	66	3	4 3 6		9	10	4 1 0
	44	4	3 6 6	East Pool	82	6	4 18 6
Fowey Consols	76	11	5 6 0		75	3, 7	4 14 6
	73	2	6 10 6	East Basset	61	8	7 0 0
	70	8	6 5 6		43	11	4 12 6
	66	2, 6	1 9 0		31	8	5 19 6
	63	10	5 10 0		18	10	9 2 0
	56	6	6 9 6	North Roskear	31	4	8 10 6
West Seaton	86	4	8 13 0		19	11	2 5 0
	67	11	2 8 0	(Basset)	49	4	4 5 6
	66	8	4 14 0	(Pendarves)	38	4	4 3 0
	61	4	5 14 6	Tolcarne	39	11	4 0 6
	58	4	7 13 6		38	2, 8, 11	3 12 6
	44	3	5 2 6	North Crofty	74	2, 8, 10	3 13 6
	18	11	1 10 0	West Stray Park.........	71	7	6 17 0
South Tolgus	77	6	5 6 0	Wheal Grenville.........	33	6	7 1 6
	76	10	3 17 0		25	2, 10	4 15 6
	54	4	3 5 0		7	2, 10	3 0 0
	50	4, 7	7 15 6		1	6	29 2 0
	30	8	5 9 0	Tresavean	48	11	2 2 6
Condurrow	102	3, 7	3 5 0		12	2, 8, 14	2 10 6
	98	8	2 11 0	Wheal Harriett	30	8	10 11 6
	10	6	6 17 0		20	8	2 4 0
Wheal Basset	69	2	6 7 6	Pembroke	20	11	0 10 6
	63	2, 6	6 10 0	East Grenville	19	11	2 16 0
	47	7	6 15 0	Emily Henrietta.........	9	10	7 1 6
	27	2	7 16 6		6	10	2 11 0
Wheal Seton	41	8, 11	1 6 6	Great Crinnis	14	9	3 1 0
	21	8	4 17 0	East Trefusis	3	2, 4	5 5 0

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.		Tons.	Amount.
Clifford Amalgam	751	£3,739 19 6	North Crofty	74	£271 19 0
Fowey Consols	404	2,123 3 6	North Roskear	137	674 4 0
West Seton	400	2,261 15 6	West Stray Park..................	71	486 7 0
South Tolgus	287	1,698 9 0	Wheal Grenville..................	66	402 19 0
Condurrow	210	649 18 0	Tresavean	60	132 6 0
Wheal Basset	206	1,377 18 0	Wheal Harriett	50	361 5 0
Wheal Seton	202	1,070 9 6	Pembroke	20	10 10 0
South Frances.....................	174	953 3 0	East Grenville....................	19	53 4 0
East Pool...........................	157	758 4 6	Emily Henrietta..................	15	78 19 6
East Basset	153	974 18 0	Great Crinnis	14	42 14 0
Tolcarne	77	294 14 6	East Trefusis	3	15 15 0

EACH COMPANY'S PURCHASE.

	Tons.	Amount.		Tons.	Amount.
1 Mines Royal............... ..	—	——	9 Bankart and Sons	80	£417 5 0
2 Vivian and Sons......	392¼	£2,197 6 1	10 Copper Miners' Co.	250⅝	1,302 9 3
3 Freeman and Co.	268¾	1,214 19 9	11 Charles Lambert	497	1,597 6 1
4 Grenfell and Sons	511	3,416 15 0	12 Newton, Keats & Co. ...	—	——
5 Crown Copper Co.			13 Alkali Co.	—	——
6 Sims, Willyams & Co. ...	323¼	1,758 4 6	14 Sweetland and Co.	4	10 2 0
7 Williams, Foster & Co. ...	590	3,359 13 3			
8 Mason and Elkington ...	632⅝	3,158 14 7	Total	3550	£18,432 15 6

Average Produce, 6⅜.
Quantity of Fine Copper, 226 tons 12 cwts.

Average Standard £124 8 0
Average price per ton 5 4 0

Copper Ores.

Sampled April 23, and sold at Tabb's Hotel, Redruth, May 8.

Mines.	Tons.	Purchasers.	Price.	Mines.	Tons.	Purchasers.	Price.
West Wheal Basset ...	68	10	£3 17 0	Copper Hill	41	5	6 4 0
	65	7	4 12 6	Wheal Margery	66	1, 5	7 15 0
	57	7	6 1 0		65	5	2 15 0
	51	7, 9	6 5 0		62	1	2 12 6
	48	5	4 10 0		5	5	14 2 0
	41	9	6 17 6	Tolvadden	43	2, 7	3 12 6
	34	6, 10	5 7 6		39	2	3 0 6
	24	9	7 8 6		39	7	4 17 0
	23	5, 9	8 8 0		21	7	10 16 6
	21	5	10 5 0		4	1	24 10 0
	20	7	14 10 0	East Alfred Consols ...	78	5	3 19 0
East Carn Brea	97	9	8 8 6		41	6	3 18 6
	68	9	3 16 0		23	5	5 1 0
	64	9	3 10 6	Wheal Agar...............	46	6	6 4 6
	56	9	3 6 0		43	5	12 5 0
	48	9	3 19 6		41	6	6 13 6
	37	2	11 14 0	Wheal Buller	70	2	3 19 6
	10	9	7 6 6		25	1	0 6 0
Par Consols...............	82	1, 3, 6	8 9 6		24	6	11 7 6
	80	8	6 6 6	East Rosewarne	26	3	5 11 0
	79	8	7 14 6		24	2	11 16 0
	28	3	4 8 0		12	3	8 14 0
Alfred Consols	57	1	3 18 6		11	3	3 12 6
	50	1	2 7 0	North Basset	37	1, 10	3 10 6
	44	7	0 19 0		30	7	5 1 0
	40	1, 7	4 4 6	South Crenver	48	1	2 5 6
	37	2, 3	1 11 6		16	1	7 4 6
	36	3	11 18 6	West Wheal Trevelyan	30	1	8 3 6
Levant.....................	85	12	1 13 6	Rosewarne Consols......	20	3	10 9 0
	65	7	6 1 0		6	1	28 0 0
	55	2	9 2 6	Boscaswell	24	1	9 3 6
	50	7	6 8 0	St. Austell Consols......	17	2, 5	3 17 0
	2	6	11 11 0	West Tolvadden	8	12	2 6 6
Copper Hill	65	5	1 16 0	Great North Tolnus ...	5	3	2 10 6
	50	1	3 13 6	Wills' Ore..................	2	5	3 6 0
	49	1, 5	2 17 0				

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.		Tons.	Amount.
West Basset.........................	452	£2,783 6 0	East Rosewarne	73	£571 15 7
East Carn Brea	380	2,182 19 6	North Basset	67	281 18 6
Par Consols	269	1,934 12 6	South Crenver......................	64	224 16 0
Alfred Consols......................	264	1,039 12 0	West Trevelyan	30	245 5 0
Levant	257	1,380 12 0	Rosewarne Consols	26	377 0 0
Copper Hill	205	694 12 0	Boscaswell	24	220 4 0
Wheal Margery	198	923 10 0	St. Austell Consols..............	17	65 9 0
Tolvadden	144	778 12 6	West Tolvadden	8	18 12 0
East Alfred Consols	142	585 3 6	Great North Tolgus	5	12 12 6
Wheal Agar........................	130	1,086 15 6	Wills' Ore..........................	2	6 12 0
Wheal Buller	119	558 15 0			

EACH COMPANY'S PURCHASE.

	Tons.	Amount.		Tons.	Amount.
1 Vivian and Sons	450½	£2,860 5 9	8 Bankart and Sons	159	£1,116 5 6
2 Freeman and Co	218¾	1,252 2 6	9 Copper Miners' Co.	445	2,466 2 6
3 Grenfell and Sons	183¾	1,323 9 9	10 Charles Lambert	103¾	418 7 9
4 Crown Copper Co..........	—	——	11 Newton, Keates & Co.	—	——
5 Sims, Willyams, & Co. ...	468¼	2,464 4 0	12 Sweetland and Co.	93	160 19 6
6 Williams, Foster & Co. ...	191½	1,340 1 6			
7 Mason and Elkington ...	456	2,570 12 3	Total..................	2876	£15,972 11 0

Average Produce, 6¾.
Quantity of Fine Copper, 192 tons 9 cwt.

Average standard £124 2 0
Average Price per ton 5 11 0

Copper Ores.

Sampled May 7, and sold at the Royal Hotel, Truro, May 22.

Mines.	Tons.	Purchasers.	Price.
Devon Great Consols	106	3	£9 10 0
	104	8	4 6 6
	102	1, 3	4 5 6
	97	3	4 14 0
	94	10	3 19 6
	93	7	3 18 0
	91	5	4 4 0
	89	2	4 5 0
	88	2	4 16 6
	86	6, 9	4 10 0
	79	5	8 14 0
	77	7	8 8 0
	75	6	8 17 6
	72	6	3 17 0
	70	1, 5	3 5 6
	69	1, 5, 10	2 16 0
	68	5	10 3 0
	65	1, 6	3 13 6
	64	6	3 14 6
	61	1	8 17 6
	60	5	5 7 0
	51	6	5 15 6
	49	1	11 3 6
	26	3	8 10 6
	24	9	4 9 6
	23	3	7 0 0
East Caradon	97	5	4 13 0
	96	5, 12	5 13 6
	95	5	5 2 6
	69	5	7 19 0
	55	1	7 1 6
	33	5	10 13 0
Phœnix Mines	107	3	5 6 6
	88	1	3 0 6
	75	3	4 2 0
	60	3	10 3 6
	58	2	4 17 6
Marke Valley	104	6	3 8 6
	101	6	3 5 0
	80	12	3 13 6
	57	8	4 17 6
	41	10	2 14 6
Hingston Down	73	7, 9	£3 6 6
	64	7, 9	4 11 0
	63	9	4 7 0
	60	9	3 0 6
	54	9	2 10 6
	46	3	6 18 0
Great Wheal Martha	100	10	1 9 6
	85	10	2 3 6
	61	1	3 0 6
	21	1	5 8 6
Holmbush	85	12	3 8 6
	68	2	10 8 6
	61	1, 6	10 11 0
	50	7	6 16 0
Lady Bertha	104	6, 10	1 19 6
	100	7, 10	2 12 6
	26	3, 6	6 5 6
Bedford United	109	8	4 7 6
	99	8	4 5 6
East Russell	69	5	2 16 0
	68	1, 6	3 0 6
	49	1, 6	7 15 6
South Bedford	103	10	2 1 0
	54	8	4 15 6
Wheal Friendship	90	2, 6	3 7 0
	54	2, 6	10 2 6
Yarner	131	12	2 16 6
Wheal Emma	47	9	4 6 6
	42	8	7 5 0
	41	12	2 0 0
Kelly Bray	72	7	3 7 0
	50	3, 7	1 5 6
Gunnis Lake (Clitters)	71	3, 7	5 2 0
	48	6	6 7 0
Okel Tor	70	12	2 12 6
	10	6	3 18 6
Brookwood	48	1, 2	4 10 6
	2	9	18 2 6
Gawton	36	7	3 11 6
Fursdon	34	5	5 13 6
Hawkmoor	30	6	4 16 6

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.
Devon Great Cons.	1,883	£10,718 10 6
East Caradon	445	2.771 17 0
Phœnix Mines	386	2,036 14 6
Marke Valley	383	1,368 1 0
Hingston Down	360	1,443 4 6
Great Wheal Martha	267	630 16 6
Holmbush	164	1,983 11 6
Lady Bertha	230	631 1 0
Bedford United	208	900 1 0
East Wh. Russell	186	779 17 6
South Bedford	157	469 0 0
Wheal Friendship	144	£848 5 0
Yarner	131	370 1 6
Wheal Emma	130	589 15 6
Kelly Bray	122	304 19 0
Gunnis Lake (Clitters)	119	666 18 0
Okel Tor	80	223 0 0
Brookwood	50	253 9 0
Gawton Copper	36	128 14 0
Fursden	34	192 19 0
Hawkmoor	30	144 15 0

EACH COMPANY'S PURCHASE.

	Tons.	Amount.
1 Vivian and Sons	589½	£3,282 18 6
2 Freeman and Co.	399	2,327 4 6
3 Grenfell and Sons	664½	4,163 5 0
4 Crown Copper Co.	—	——
5 Sims, Willyams & Co.	801	4,756 4 0
6 Williams, Foster & Co.	856½	4,185 9 0
7 Mason and Elkington	507	2,330 10 9
8 Bankart and Sons	465	£2,190 1 6
9 Copper Miners' Co.	361½	1,399 5 9
10 Charles Lambert	548	1,327 5 0
11 Newton, Keates & Co.	—	——
12 Sweetland and Co.	455	1,493 7 0
Total	5647	£27455 11 0

Average Produce, 6½
Quantity of Fine Copper, 350 tons 10 cwt.

Average Standard ……………… £122 13 0
Average Price per ton ………… 4 17 0

Copper Ores.

Sampled April 9, and sold at Swansea, April 29.

Mines.	Tons.	Produce.	Purchasers.	Price.
Berehaven	98	10½	10	£8 17 6
	83	10½	14	8 18 6
	120	10¼	5	8 10 0
	84	10⅝	7	8 14 6
	126	11⅛	6	9 10 0
	117	10⅞	2	8 14 0
Cobre	90	10⅞	14	8 6 0
	86	10¼	6	8 5 0
	73	10¾	7	8 6 6
	89	10	6	8 10 0
	83	10⅛	6	8 11 0
	74	10⅞	1	8 5 6
Knockmahon ...	69	12¼	6	11 2 0
	68	12⅛	7	10 14 6
	60	12⅝	6	10 13 0
	102	13	6	11 6 0
	80	8¾	7	7 9 0
	100	12⅜	6	10 14 0
Ookip	63	34	6, 7	29 18 0
Ookip..............	60	33⅛	3, 6	£29 16 0
	59	33⅞	5	29 16 6
	25	31	3	27 17 0
Wheal Maria ...	53	24⅛	3	21 18 0
	38	23½	3	21 0 6
Springbok	1	9½	3	8 0 0
Ballycummisk...	37	14¼	7	12 9 0
	29	9⅞	2, 6	7 15 0
	37	4⅞	2, 6	3 7 0
Carthagena......	41	8¾	3	8 15 0
	2	38⅞	2	30 10 0
Worthing Reg..	37	58⅛	14	52 14 6
Schull Bay	20	12¼	1	10 10 0
Halvan............	10	3½	6	2 11 0
Mines Ryl Slag.	20	13⅜	5	11 2 6
Spanish............	5	17⅛	16	15 13 6
	1	17	16	14 15 0
	1	13⅞	16	10 10 0
Phœnix	1	6⅛	6	4 18 0

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.
Berehaven	628	£5,578 6 6
Cobre	495	4,142 14 6
Knockmahon	469	4,846 6 0
Ookip	207	6,127 13 6
Wheal Maria	91	1,959 13 0
Springbok	1	8 0 0
Ballycummisk......................	93	809 7 0
Carthagena.........................	43	£419 15 0
Worthing Regulus	37	1,950 16 6
Schull Bay	20	210 0 0
Halvan	10	25 10 0
Mines Royal Slag	20	222 10 0
Spanish...............................	7	103 12 6
Phœnix Ore........................	1	4 18 0

EACH COMPANY'S PURCHASE.

	Tons.	Amount.
1 Copper Miners' Co.	94	£822 7 0
2 Freeman and Co.	152	1,253 5 0
3 Grenfell and Sons	188	3,916 13 0
4 Crown Copper Co..........	—	——
5 Sims, Willyams & Co. ...	109	3,002 3 6
6 Vivian and Sons............	810½	8,934 5 0
7 Williams, Foster & Co....	373¼	4,068 8 6
8 Mines Royal	—	——
9 British and For. Copper Co............................	—	——
10 Mason and Elkington...	98	£869 15 0
11 Bankart and Sons	—	——
12 Charles Lambert.........	—	——
13 Ravenhead Copper Co.	—	——
14 Sweetland, Tuttle & Co.	210	3,438 12 0
15 Bold Copper Co.	—	——
16 Jennings and Co....	7	103 12 6
Total	2132	£26,409 3 6

Black Tin Sales.

Date.	Mines.	Tons. c.	q. lbs.	Price per ton £ s. d.	Purchasers.	Amount of Money. £ s. d.
April 16.	West Fowey Con...	34 16	1 10	63 15 0	——	2253 18 9
" 17.	" ...	0 15	1 3	45 0 0	——	
" 24.	Par Consols	60 8	2 22	63 15 0	——	3852 14 3
" 28.	Prideaux Wood ...	2 13	3 3	63 0 0	——	177 14 3
	" ...	0 3	2 22	45 0 0	——	
May 2.	Cornubia	2 10	1 2	68 0 0	——	170 18 2
	Drake Walls	7 2	1 5	67 7 6	——	1269 19 3
	"	12 4	2 20	64 12 6	——	
" 3.	Basset and Grylls.	22 5	2 27	—	——	1232 14 7
" 6.	Gurlyn	6 13	3 25	63 15 0	Chyandour	427 0 6
" 10.	Gt. Wh. Vor	23 5	0 11	—	——	1556 8 7
	Penhalls	6 2	1 17	—	Calenick	385 11 3
	Kitty (St. Agnes) .	8 14	3 18	—	ditto	518 3 5
" 13.	Brea Consols	3 13	1 23	69 7 6	R. R. Michell and Co.	309 10 0
	"	0 13	3 24	60 10 0	ditto	
	"	0 6	0 9	41 0 0	ditto	
" 14.	So. Carn Brea......	4 16	1 1	60 12 6	Bissoe	634 7 11
	"	5 18	0 3	60 12 6	Carvedras	
" 16.	Trevenen	5 13	3 7	68 10 0	Enthoven and Sons............	432 18 1
	"	1 0	0 24	42 0 0	ditto	
	Wheal Vyvyan ...	2 11	3 24	62 10 0	ditto	180 11 0
	" ...	0 9	0 9	40 0 0	ditto	
" 17.	Gt. Wh. Fortune...	23 17	0 25	—	——	1622 15 0
	Pedn-an-drea	10 15	0 23	—	——	678 18 11

Copper Ores.

Sampled April 23, and sold at Swansea May 13.

Mines.	Tons.	Produce.	Purchasers.	Price.	Mines.	Tons.	Produce	Purchasers.	Price.
Cobre	101	10⅝	3	£8 15 0	Cuba Ore.........	90	12	2	£10 0 0
	96	10⅛	3	8 15 0		87	11⅛	7	10 3 0
	94	10⅝	11	8 10 6		40	20¼	3	17 11 6
	90	10⅜	6	8 16 0		48	20⅝	6	17 9 0
	52	20⅝	5	18 2 6		46	20⅞	6	17 8 0
	47	20⅛	3, 7	17 15 0	Precipitate ...	5	62	5	50 14 0
	13	57	11	45 17 6	Gt. Northern Mining Co. of South Aus. ...	97	17	1	14 12 6
	102	11	6, 7	9 14 0		30	13⅛	1	11 17 0
	92	11⅛	3	9 10 0		10	15	1	13 1 0
	100	11⅝	1, 7	9 7 0		9	22⅝	5	19 12 0
Knockmahon ...	189	10⅛	6	8 13 0		6	20⅝	1	17 0 6
	67	12	6	10 7 0		5	18¾	1	16 0 6
	66	12⅜	7	10 17 0		2	36⅝	2	29 17 0
	118	12⅞	6	11 2 0		1	29	2	22 0 0
	63	14⅝	7	12 2 0		3	8⅝	6	7 14 0
	93	13	6	11 4 0	Wheal Maria ...	57	23¼	10	20 14 6
Berehaven......	128	10⅛	14	8 12 0		52	23¾	12	21 7 6
	81	10⅝	10	8 16 6	Ookip	26	28¼	5	25 7 6
	100	9⅞	2, 7	8 5 0	Llandudno	67	2	5, 6	1 1 0
	36	9⅜	3	8 5 0		37	1¾	16	0 16 6
	100	11⅛	2	9 10 0	Mines Ryl. Reg.	21	49	5	44 6 0
	82	11	1	9 9 0		20	43¼	5	38 10 0
Cuba Ore.........	98	11⅞	7	9 19 6	British Reg. ...	30	28¼	16	25 0 0
	95	11⅞	7	9 19 6					

TOTAL PRODUCE AND VALUE.

	Tons.	Amount		Tons.	Amount.
Cobre	787	£8,488 12 6	Wheal Maria	189	£2,292 16 6
Knockmahon	526	5,552 12 0	Ookip	26	659 15 0
Berehaven	527	4,600 10 6	Llandudno	104	100 17 6
Cuba.............................	518	6,460 18 0	Mines Royal Reg................	41	1,700 6 0
Gt. Northern (S.A.)	163	2,368 2 0	British Regulus	30	750 0 0

EACH COMPANY'S PURCHASE.

	Tons.	Amount.		Tons.	Amount
1 Copper Miners' Co............	280	£3,329 6 0	10 Mason and Elkington......	138	£1,896 3 0
2 Freeman and Co...............	243	2,344 4 0	11 Bankart and Sons	107	1,397 14 6
3 P. Grenfell and Sons..........	397¼	4,173 1 0	12 Charles Lambert	52	1,111 10 0
4 Crown Copper Co.............	—	——	13 Ravenhead Copper Co. ...	—	——
5 Sims, Willyams & Co.	166¼	3,767 12 6	14 Sweetland, Tuttle & Co.	128	1,100 16 0
6 Vivian and Sons...............	668¼	7,057 3 6	15 Bold Copper Co.	—	——
7 Williams, Foster & Co.......	583½	6,078 9 0	16 Jennings and Co............	67	780 10 6
8 Mines Royal	—	——			
9 British and For. Copper Co.	—	——	Total....................	2831	£33,036 10 0

Sundry Copper Ore Sales.

Date.	Mines	Tons. c. q. lbs.	Price per ton. £ s. d.	Purchasers.	Amount of Money. £ s. d.
April 8.	Greenbourne	20 12 2 23 ...	5 17 6...	Bibby, Sons, & Co. ...	185 11 11
„ 21.	„	14 2 3 14 ...	4 11 6...	ditto	
„ 15.	Alderly Edge (precipitate)...	11 3 1 0 ...	57 5 5...	Sims, Willyams & Co.	639 6 0

Blende Sales.

Date.	Mines.	Tons.	Price per ton. £ s. d.	Purchasers.	Amount of Money. £ s d.
April 29.	Minera	42 ...	2 10 6 ...	A. Courage and Co.	307 9 0
	„	50 ...	2 10 6 ...	ditto	
	„	22 ...	1 10 6 ...	ditto	
	„	16 ...	2 12 0 ...	ditto	

Lead Ore Sales.

Dates.	Mines.	Tons.	Price per Ton. £	s.	d.	Purchasers.	Amount of Money. £	s.	d.
April 22.	Penpompren	40	13	6	0	Sims, Willyams & Co.	532	0	0
" 24.	Isle of Man Mining Co.	100	13	11	6	Walker, Parker & Co.	1775	5	0
	"	30	13	18	6	Locke, Blackett & Co.			
	Westminster	50	10	18	6	Walker, Parker & Co.	546	5	0
	Mount Pleasant	35	11	0	0	Adam Eyton	385	0	0
	Hendre Ucha	16	11	3	6	A. Courage and Co.	265	1	0
	"	5	13	5	0	Walker, Parker & Co.			
	Bryngwyn	27	11	10	6	ditto	439	8	6
	"	10	12	16	6	ditto			
	Dyliffe	60	11	11	0	ditto	693	0	0
	Dyfngwm	41	11	8	0	Newton, Keates & Co.	467	8	0
	Rhoswydol	12	10	15	6	ditto	129	6	0
	Roman Gravels	35	11	6	6	Walker, Parker & Co.	396	7	6
	Pool Park	17	11	17	0	ditto	246	7	0
	"	4	11	4	6	A. Courage and Co.			
	Park	30	10	19	0	Adam Eyton	328	10	0
" 26.	North Laxey	15	12	2	0	ditto	181	10	0
" 29.	Minera	100	11	12	6	Locke, Blackett & Co.	5356	5	0
	"	100	12	0	6	James, McNicoll & Co.			
	"	80	11	15	0	Panther Co.			
	"	100	11	18	6	Locke, Blackett & Co.			
	"	70	12	2	6	McNicol and Co.			
" 30.	Wheal Mary Ann	63	24	3	0	Stock and Co.	1851	9	0
	"	30	11	0	0	Pontifex and Wood			
May. 3.	Bronfloyd	20	13	6	6	Walker, Parker & Co.	266	10	0
" 5.	Glogfach	60	14	16	0	R. Michell and Son	888	0	0
	East Logylas	70	11	6	0	Panther Co.	791	0	0
	Cwmystwith	50	11	13	6	ditto	1175	0	0
	"	50	11	16	6	ditto			
" 6.	North Minera	20	11	6	0	Walker, Parker & Co.	226	0	0
" 7.	Llanfyrnach	20	12	10	0	Sims, Willyams & Co.	286	15	0
	"	5	7	7	0	ditto			
" 8.	Talargoch (Maesyrerwddu)	53	12	6	0	Adam Eyton	923	6	6
	" (Coetia Llys)	21	12	18	6	Walker, Parker & Co.			
	Deep Level	10	11	11	0	ditto	115	10	0
	Rhosesmor	45	11	0	6	ditto	496	2	6
	Orsedd	10	11	11	0	A. Courage & Co.	115	10	0
	Bryn Gwiog	35	12	3	6	Walker, Parker & Co.	426	2	6
	Parrys	30	11	17	6	ditto	356	5	0
	Holywell Level	10	13	10	6	ditto	135	5	0
	Long Rake	15	11	18	6	Newton, Keates & Co.	178	17	6
	West Merllyn	5	12	4	6	ditto	61	2	6
	Merllyn	4	11	15	0	A. Courage and Co	47	0	0
	Llangynog United	16½	11	15	6	Walker, Parker & Co.	194	5	6
	Dyliffe	52	12	12	0	Adam Eyton	983	18	6
	"	27	12	3	6	Newton, Keates & Co.			
" 9.	Treweatha	½	16	8	0	Stock and Co.	8	4	0
	Cargoll	90	14	0	0	T. Somers	1260	0	0
" 15.	Isle of Man Mining Co.	100	22	3	6	Treffry's Estates	2217	10	0
" 17.	Laxey	100	17	4	6	R. Michell and Son	1722	10	0
" 19.	Frongoch	224	12	1	0	Sims, Willyams & Co.	2699	4	0
	Cefn Brwyno	65	12	4	0	ditto	793	0	0
	East Darren	85	14	15	0	Adam Eyton	1253	15	0
	Cwm Erfin	25	13	13	0	Panther Co.	701	12	0
	"	25	14	7	6	ditto			
" 21.	Dyfngwm	65	12	5	6	Walker, Parker & Co.	797	17	6
	Rhoswydol	13½	11	11	6	ditto	156	5	3
	Dyliffe	55	12	5	6	Adam Eyton	675	2	6
	Aberdovey	26	12	0	6	Walker, Parker & Co.	312	13	0
	Cowarch	11	10	17	6	A. Courage and Co.	119	12	6
	Caylan	3	8	17	6	Walker, Parker & Co.	26	12	6
	Nant-y-Iago	12	11	11	0	Adam Eyton	138	12	0

INDEX.

A.

B.

C.

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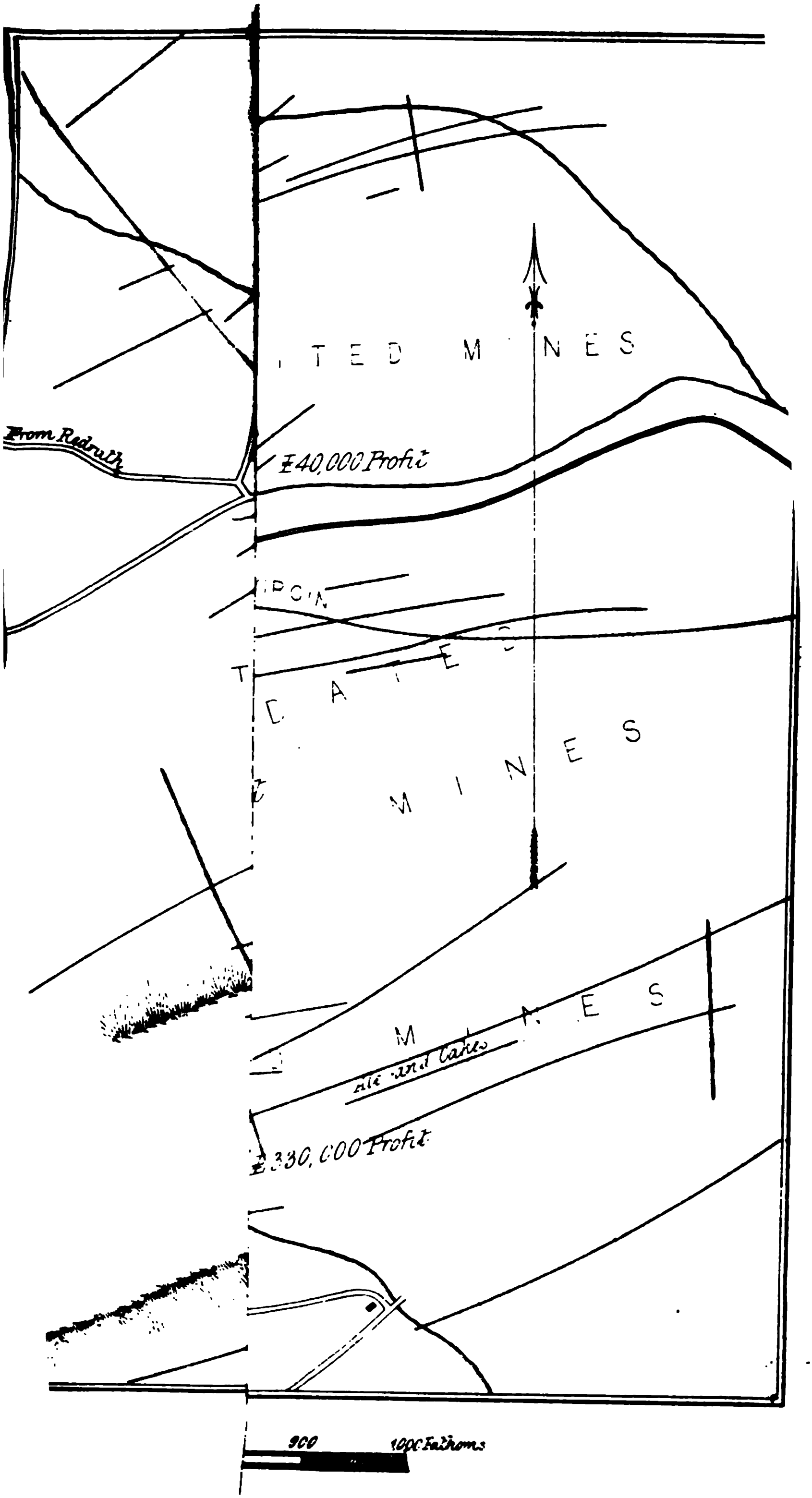
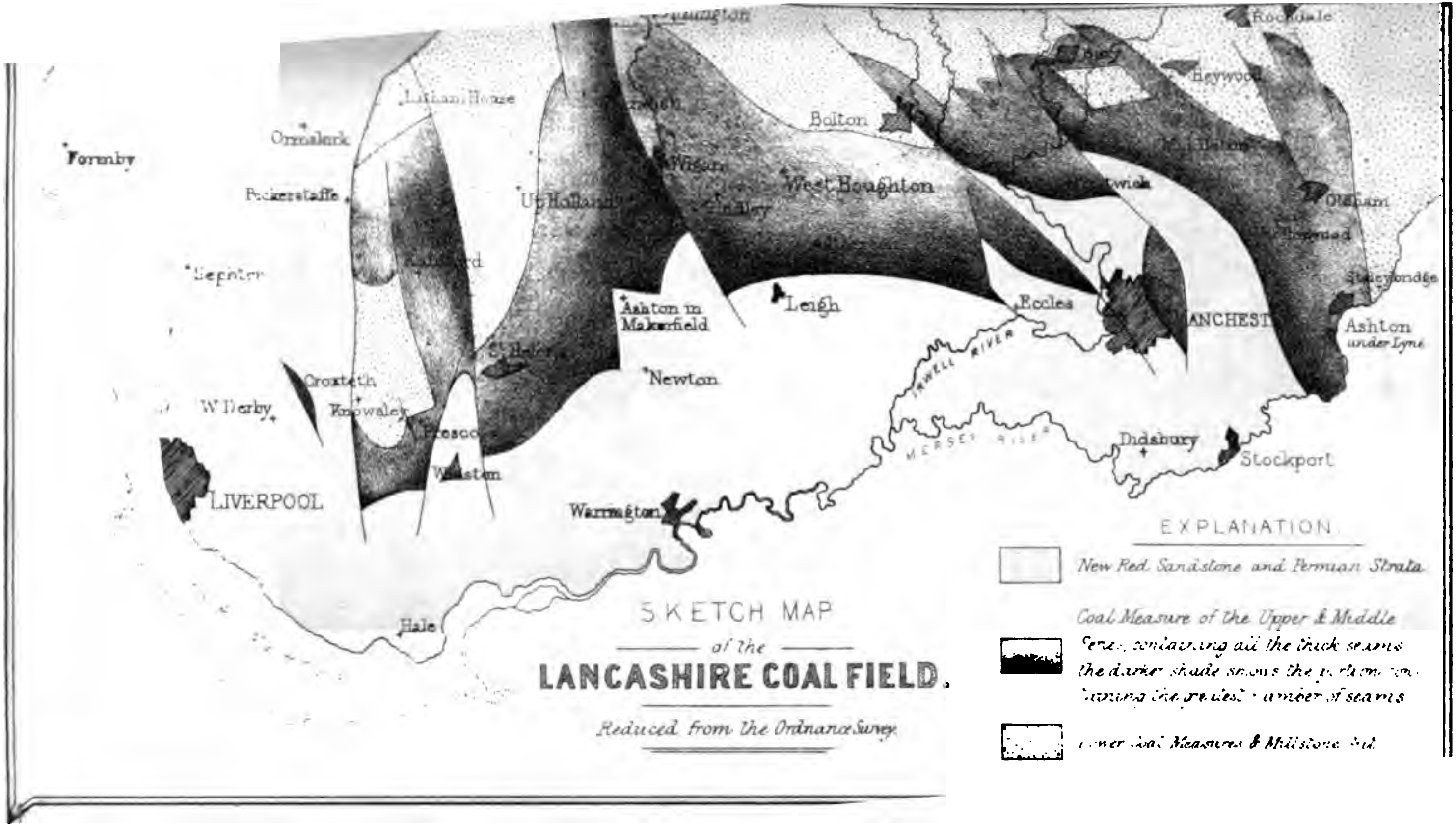


ITED MINES
From Redruth
£40,000 Profit
IRON
TATES
MINES
MINES
£330,000 Profit
900
1000 Fathoms


SKETCH MAP
of the
LANCASHIRE COAL FIELD.
Reduced from the Ordnance Survey.
EXPLANATION.
New Red Sandstone and Permian Strata.
Coal Measure of the Upper & Middle
Formby
Ormskirk
Lathan House
Bickerstaffe
Up Holland
Wigan
West Houghton
Bolton
Heywood
Oldham
Ashton under Lyne
Stockport
Didsbury
Eccles
Leigh
Ashton in Makerfield
Newton
Croxteth
W Derby
Knowsley
Whiston
LIVERPOOL
Warrington
Hale
IRWELL RIVER
MERSEY RIVER

Mn

Plate III.

Furnace at Blaenavon.

Bla

Gas

Fig. 6.

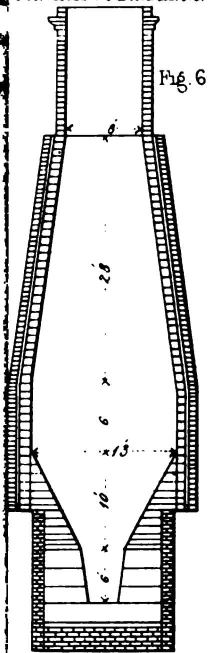


Fig. 8.

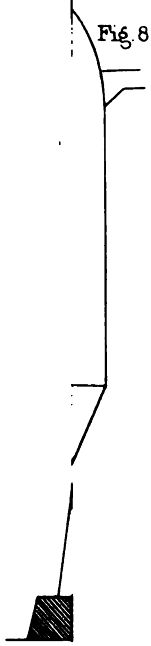


Fig. 9.

Old form of Cleveland Furnace

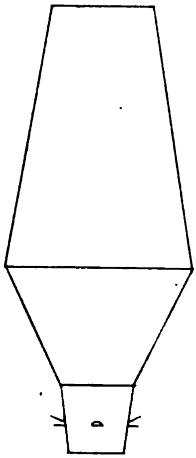
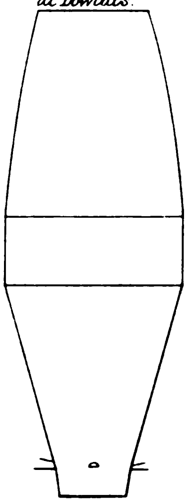


Fig. 12.

Ordinary Form at Dowlais.



15.

Moor.

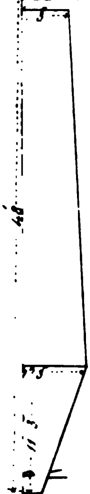
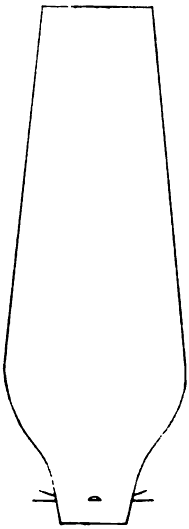
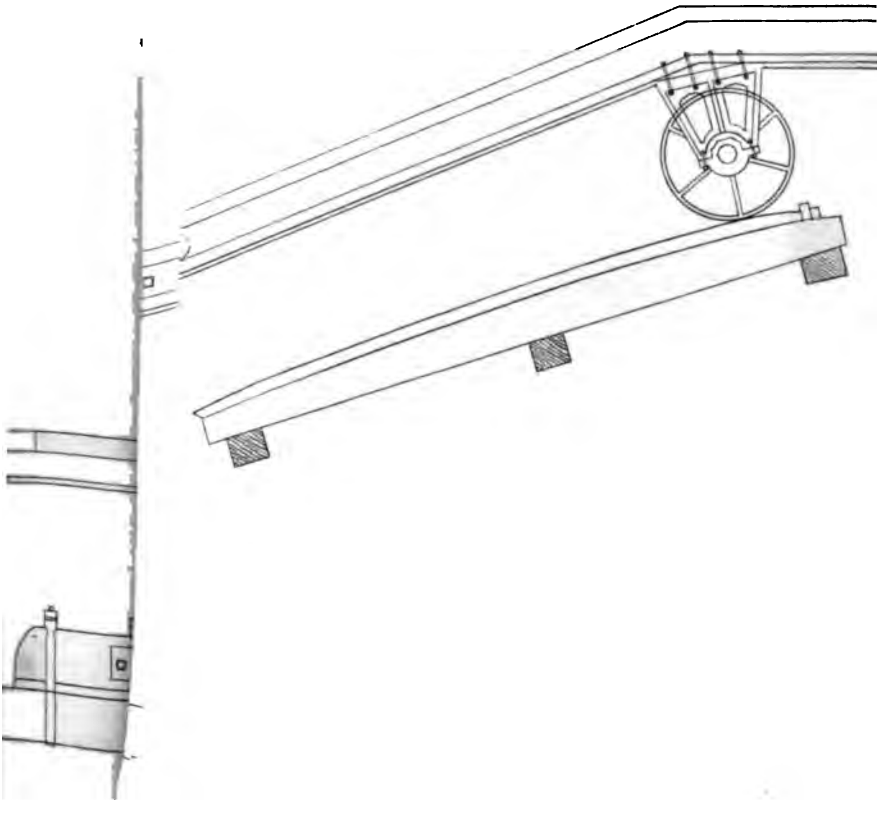


Fig. 16.

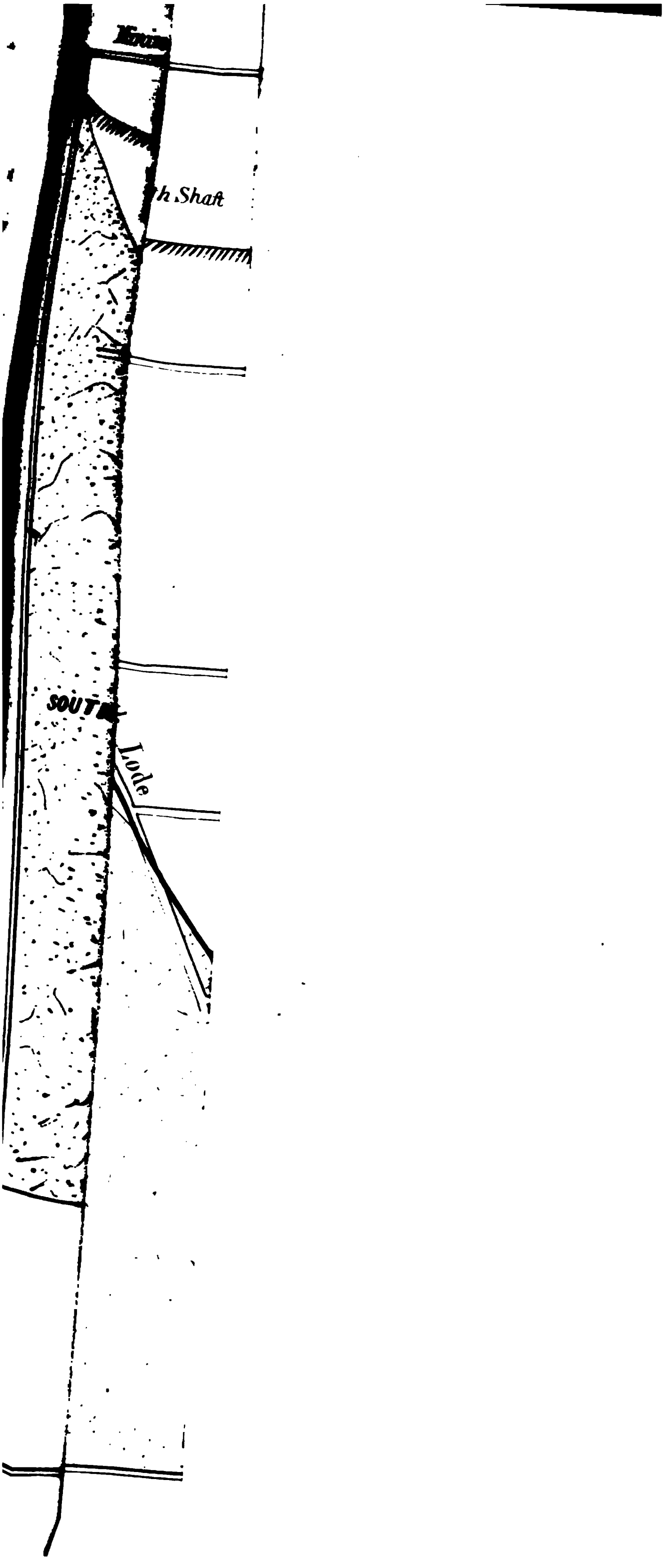


CAP

Altering



Harrison & Sons St Martins Lane


h Shaft
Lode

THE

MINING AND SMELTING MAGAZINE:

A MONTHLY REVIEW OF

PRACTICAL MINING, QUARRYING, & METALLURGY,

AND

Record of the Mining and Metal Markets.

EDITED BY

HENRY CURWEN SALMON, F.G.S., F.C.S.

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THE

MINING AND SMELTING MAGAZINE.

JULY, 1862.

The Coal-Fields of Hungary.

By Professor D. T. Ansted, M.A., F.R.S., etc.

Hungary is rich in mineral wealth of all kinds. The gold of Nagyag, in the Siebenbürgen; silver in many localities, both native and in the form of sulphuret, as well as combined with lead; rich ores of lead; ores of copper, tin, zinc, antimony, and some of the rarer metals, of which tellurium is the most remarkable: these are all recorded in every book of mineralogy from Hungarian localities. Far superior, however, to these in value, rich ores of iron and beds of coal have been found forthcoming when most wanted; and within the last twenty years several coal-fields of more or less importance, and very valuable veins and deposits of the oxides and carbonates of iron have been rendered available in the development of the mineral resources of the country.

Very little is known in England of these coal-fields, and some account of the most productive and most promising may be interesting to many of the readers of the *Mining and Smelting Magazine*. The following remarks are the result of a personal investigation made during the present year:—

The mineral fuel at present obtained from mines in Hungary is partly brown coal and partly stone coal. The former is generally tertiary in its geological origin. The latter, does not, as in England, belong to the older or palæozoic formations, but is partly of the older secondary and partly of the middle tertiary period. The particulars of each principal deposit will be given presently.

The coal-fields extensively worked in Hungary are as follows, those yielding the largest supplies being named first. (1.) The *Fünfkirchen* field, supplying the steam-boats of the principal company navigating the Danube, and belonging chiefly to the company. (2.) The *Oravicza* field, supplying the railway from Vienna to Baziasch, the steam-boats on the Danube belonging to the railway company, and certain iron works. (3.) The *Oedenburg* field, chiefly supplying Vienna; and the *Gran* field, supplying Pesth and some other towns, and some steam-boats.

In addition to the above there is a very remarkable and promising coal-field in the *Zsil* valley, on the Wallachian frontier of the Siebenbürgen, not yet opened owing to the want of railway communication. There are also several small fields of true coal of various ages, some opened and some only known by the outcrop of the coal, but none of them very promising. Several large deposits of brown coal are little developed. One of them situated at Borsod, near the principal branch of the Theiss railway, is partly opened. Many others are known.

The Funfkirchen Coal.

This is at present the most valuable and the most developed of the Hungarian coal-fields. About 140,000 tons were raised in 1861; but the annual increase is very large, and must become much larger when the railway from Fünfkirchen to Kanisha is completed and the coal-field is put in direct communication by rail with Fiume, Trieste, and other ports of the Adriatic, as well as many towns in north Italy.

The Fünfkirchen coal-field is about thirty-five miles from the Danube, on the left bank of the river. The nearest town on the Danube is Mohacs, unimportant except as the shipping place for the coal. There is direct communication by rail from the pits to the river, and an extension of this rail westwards to the Kanisha station would, as already stated, bring the coal into the line of railway connecting Ofen (Pesth) with Trieste, and entering the main south Austrian line at the Prager Hof station.

The coal of Fünfkirchen belongs to the lower oolitic or liassic series, and corresponds geologically with the poor coals found in the Yorkshire oolites, or rather with the woody fragments in the alum shales of Whitby. It is, however, a true coal. It crops out on a curved line, following the course of some hills behind the town of Fünfkirchen to the north. The total length of this line of crop is about eight English miles, but the part hitherto worked is very much less. The available breadth is estimated at about 800 yards. To the north-east the coal is cut off by eruptive rocks, and towards the south-west it is lost under a thick cover of unconformable tertiary deposits. The dip is generally very heavy, rarely less than 30°, and sometimes more than 70°; 45° may be considered as an average. The dip is generally more or less southerly. There are few faults or heaves known, and only one of any magnitude.

The total number of seams regarded as workable is twenty-five. Of these four are above 6 feet thick, and eight between 3 and 6 feet thick, the remaining thirteen are from 18 inches to 3 feet. Many of the thinner seams, but few of the thicker, are separated by partings. The upper seam is valueless, owing to the large quantity of impurities it contains. A few bands of ironstone have been found near the coal.

The coal is got by shafts, the deepest of which at present is less than 80 fathoms down. There is little water anywhere underground, and small 20-horse power reciprocating engines lift coal as well as water in several of the principal shafts. No water-power exists in the neighbourhood. The shafts and levels are well

timbered throughout, and all reasonable care is taken against the accidents incident to mining. Gas has not yet been met with in sufficient abundance to require the use of safety lamps.

The quality of the coal is peculiar. More than 90 per cent. either comes up as dust, or is reduced to dust by turning over once or twice. The few lumps are generally pyritous or brassy, and a heap of the small coal, exposed to a shower of rain, effloresces, and is soon covered with white and yellow crystals, chiefly of alum. The whole of the coal is very dirty, containing a variable but large proportion of slaty matter. The proportion of ash varies from 6 to 15 per cent.

Notwithstanding these great disadvantages, it burns remarkably well, without much smoke, and gives an intense heat with some flame. In many respects it resembles the powdery coals near the anthracite beds in South Wales rather than any of the English coals. Some of the poorer Scottish coals are also somewhat like it. It is in all respects very much better than it looks, and is a very valuable fuel.

The great dip of the coal in this field involves the necessity of its being worked more in the manner of the French and Belgian mines than of ordinary English coal mines. There are many shafts, and wherever the state of the roof and floor will at all admit of it the whole of the coal is got in successive drifts at different levels. Generally the roof is good and the floor poor. Sandstone and shale, as usual, are the rocks associated with the coal.

The best part of the Fünfkirchen coal consists of two thick seams, separated by about 9 fathoms of rock, chiefly sandstone. These seams vary from 6 to 8 feet. Below them, at some distance, are two other tolerable seams. The whole of this part of the coal lies in the lower division of the coal-bearing series, and under more than a hundred fathoms of rock, in which are many small seams of coal and some bands of ironstone.

Thick bituminous shales are found alternating with the sandstones, but they are too poor in valuable products to be worth distilling.

At present, almost the whole of the concessions granted in the district and worked to profit are in the hands of the Danube steam-navigation company, who have also the railway from the mines to river. The coal is brought out of the mines at the lowest adit, being lifted only to that level. It is then conveyed on small rails by horse power to a central point, where it is transferred to the coal trucks to be conveyed to Mohacs. It is there stored in the open air, being removed from the trucks in barrows. It is also carried on board in small barrows. It is thus turned over four times, and is much injured thereby, scarcely any thing but dust reaching the fires. With most coals this would be fatal, but it is found by experience that when put on the fire, however small it may be, the surface at once cakes on the side next the fire, and a coking process goes on slowly towards the less heated surface, the whole burning away gradually, but getting up steam rapidly, and continuing to burn with uniform heat until consumed.

Attempts have been made, but hitherto without much success, to

make the dust into bricks, which will bear transport. All combining materials are too costly, and compression has not yet been found to answer.

Besides the concessions now worked, a large number have recently been purchased at a high price by a German company, which will open an extension of the field at Waschau. There would now be no outlet for coals there raised, but when the railway is opened to Kanisha there will be ample room for development in this direction also.

Labour is chiefly obtained from a distance. Almost all the superior employés are from various parts of Germany, and among the miners are many from Bohemia and Wallachia, but few from the neighbourhood. The people are well cared for,—they live in houses built barrack-fashion, each family having one, two, or more rooms, according to its magnitude. A man with very moderate industry can earn a florin (about 1*s.* 8*d.*) per diem, which is much more than the pay of ordinary labour in the neighbourhood. With a little effort this may be almost doubled. The rent paid for two rooms is 8 florins (5*s.*) per month.

The Oravicza Coal-Fields.

Oravicza is situated in the south of Hungary, in the Bannat, at a distance of twenty-seven miles from the main line of railway from Vienna to the Danube at Baziasch. It communicates with the main line at Jassenova, fourteen miles from Baziasch. The branch is at present only completed to Oravicza, but is intended to reach Reschitza, about fifteen miles beyond, where are very extensive iron works, consisting both of high furnaces for smelting, and rolling mills for manufacturing bar and sheet iron of the largest dimensions. This line is expected to be open next year throughout. The main line is not likely to be carried beyond Baziasch, permission having been refused for political reasons.

A number of extremely small coal-fields extend round Oravicza, and a large amount of metal industry is concentrated there. Among other matters a very interesting vein of gold is worked to profit, close to the town. The town itself consists only of one street, about two miles in length; it is modern, and bears distinct marks of its recent growth and present prosperity.

Most of the Oravicza coal-fields, like those of Fünfkirchen already described, belong to the lower oolitic or liassic period. One is said to be of the ordinary carboniferous period: it is extremely minute, but is considered to contain good coal.* I had not time to visit it. The only coal-field of present importance is that of Steuerdorf, about five miles from Oravicza, and as yet not reached by the rail. This coal field has been known since 1793, but only opened to any extent since 1845. It now supplies the railway and the steam-boats on the Danube belonging to the railway company; and the amount

---

* This coal is at Klokodic. At Doman is a small lias field, coal from which is used at Reschitza. Szekul, near Reschitza, also yields a considerable supply. It is another of the same group.

raised has latterly been about 70,000 tons per annum. No doubt as soon as the railway is completed to the mines and to Reschitza, this quantity will be very largely increased; till then it seems to have reached its limit, the coal being carted over bad roads, which in winter, and after rain, must be impassable.

The Oravicza coal-field is very small, and to English readers will seem insignificant. It is not so by any means, but, on the contrary, has already tended to develop the resources of this part of Hungary to an extent scarcely credible. Were it not for this coal, the railway could hardly have been brought to the Danube at this point with any chance of success, and the navigation of the Danube would have been left entirely in the hands of the steam-boat company. Admirable as are the arrangements of that company, there is no doubt that a little healthy competition has been greatly to the advantage of the public.

The coal crops at Oravicza on the outside of an inverted basin, the beds dipping away from the central axis. The direction of the axis is from north-east to south-west, and its extreme length is only about four miles; there is only one seam of great importance, and its thickness varies from 6 to 12 feet. There are two others, both workable, between 3 and 4 feet thick. The beds as at present known, dip very heavily, in some places being almost vertical: there are systems of faults at the extremities of the field. The coals are separated by sand rock. There are two principal divisions of the series—the upper beds, containing the thick coal, and one other workable seam, being separated from the lower beds by about 60 fathoms of sandstone. There are two partings in the thick coal, but they are not always separated. Over the top coal, which is a 3-foot seam, there is about 40 fathoms of bituminous schist, in irregular strata, alternating with very bituminous ironstone bands, also irregular, of which there are nine. The richer parts of the bituminous schist have been used for distilling, and there is a large distilling house in the coal-field, whence the oils are carried to Oravicza, and there separated. They are said to be poor in paraffine.

The quality of the coals is somewhat different, though all are poor, slaty, moderately hard, and rather brassy. In the top seam there is so much gas that explosions sometimes occur in the mines; the main, or thick seam, is less gassy, and gives a fair proportion of good coal. Much of the small coal is washed and coked: the coke is only moderately good, but is available for various purposes. A much larger proportion of the coal is hard than is the case at Fünfkirchen, but the heating power is considered inferior.

At present only the northern extremity of the coal-field is worked for coal, the ironstone and schist being obtained from the other or southern extremity. The greatest depth reached is under 80 fathoms. There is much more water than at Fünfkirchen, an 80 horse-power engine being required to clear the principal shaft. The work is carried on as at Fünfkirchen, in successive levels, and the whole of the coal is said to be good. Much timbering is necessary, but the surrounding forests yield an ample supply on very favourable terms. The props are not removed after the coal is taken.

THE OEDENBERG AND GRAN COAL-FIELDS.

Under this general heading we may include a vast multitude of deposits of mineral fuel of a very peculiar kind, little known by experience in England, but common in various parts of Europe, and perhaps attaining their greatest value in Hungary. The term lignite, or brown coal, is generally given to these coals. They are of tertiary origin, associated with soft clays instead of shales, and soft, marly sands instead of sandstone; they are often enormously thick, but rarely extend in uniform deposits over any large area. Sometimes they are brown, woody, tough, and separate into distinct fragments, —evidently once trunks of trees; often though brown they appear in the mine like coal, and may be worked in the same way, but when exposed to the air and dried, they split up, showing woody fibre. These are the less perfect brown coals. They contain a large percentage of water and ash, and often require roasting before use. In the east of Europe, and especially in Hungary, are vast tracts of sand and marl of tertiary origin, and often appearing to be of very recent date (though really older than they look), amongst which are bands of brown coal of a better quality, containing far less water and less ash, and corresponding much more with real coals. When seen in the mine, or recently brought out, they are bright, black, clean-looking coals, with good conchoidal fracture, very light, burning readily with a long flame, getting up steam very well, and answering all the ordinary requirements of a mineral fuel. But with a very short exposure to the sun and rain, the largest pieces will break up into smaller, and the smaller fall to powder, so that after three weeks or a month, the whole is reduced to dust. Well sheltered, they last longer, but three or four months in summer, and five or six in winter, are sufficient to destroy their value and render them unsaleable.

Such is the coal of Oedenberg, Gran, and a number of other places in Hungary. In the absence of a better fuel, and while fresh, it finds a ready market; and its production is limited only by the want of cheap carriage. At Oedenberg there is a railway affording direct communication with Vienna, distant fifty miles; at Gran there is the Danube, only two or three miles away, and in each place the annual production approaches 15,000 tons. There is little difference either in the nature of the coal, the mode of its occurrence, or the beds with which it is associated. In some places there are seams tolerably regular, two, three, or four feet thick, while in other places, not far off, are masses twenty, thirty, or fifty feet thick. Some of the beds may be traced two or three miles or more, others only a few hundred yards. Occasionally there are regular systems of faults as in our coal beds. Sometimes the apparent dip is moderate or imperceptible, but not far off it will be 15° or 20°, and now and then is much more.

The coal worked near Gran, about fifty miles below Pesth, on the Danube, is the only one of the group that I will allude to specially. There are here in a small district, two or three systems of deposits, but all have the same alternations of sandy marl and sandy clay with marly clay. Generally throughout the district a clay of a foot or two

thick, loaded with marine shells, overlies the top coal, whatever that may be. It is usual to bore 60 or 70 fathoms through the soft rock, and if this clay is reached the coal is found, and a shaft put down; if not, they try elsewhere. Once reached, the coal is got by drifts in the usual way, but the ground is extremely tender, and requires the closest timbering. There is little or no water, no gas, and rarely any foul air, so that ventilation is not difficult.

The Gran coal is bright in the mine, but full of shaly partings, which diminish its value, and is mixed with a good deal of pyrites, which occasionally heats and burns. Most of the shaft piles show distinct marks of having been burnt.

Until the Fünfkirchen coal superseded its use, the Gran coal was very largely purchased and used by the Danube Steam Navigation Company. The company competing with this older establishment still use it in their down trips, but require the Fünfkirchen to work up against the stream. It is chiefly now used in Pesth both for private houses and manufactories. It sells for about 8*s*. per ton on the spot, unscreened; the best screened coal fetches about double this, or 16*s*. per ton in Pesth, and the dust and small are sold in Pesth for about 8*s*.; delivered screened on board the steamers or other boats on the Danube, at the nearest station to the mines, it fetches rather less than 11*s*. The works are carried on with a certain degree of irregularity, as they are of necessity regulated by the demand. No stock can be kept, and little more than a few days' supply can ever be raised safely till late in autumn, when it has to be stored for winter use in Pesth.

It is a remarkable and interesting fact, that scarcely any remains of leaves have been found in the clays or sands near this coal, and that the shells found above or below are of marine origin.

The Zsil Coal-Field.

This coal-field is still in the condition of those of Fünfkirchen and Oravicza a quarter of a century ago, before railroads had penetrated into Hungary. It is situated on the borders of Hungary and Wallachia, about fifty miles south of the present post road from Arad and Temeswar to Hermannstadt, one of the chief towns of the Siebenburgen. Arad and Temeswar are both railway stations, the latter on the main line to Baziasch from Vienna; the former on one of the branches of the Theiss railway. From Arad it is contemplated to continue the line of railway through Eastern Hungary and to the Black Sea. The exact line is not yet determined, but there are few practicable passes in the Carpathians, and this great mountain chain must somewhere be crossed. The line is expected to pass up the valley of the Maros as far as Piski. Whether it then turns southward into Wallachia, or continues eastwards to Hermannstadt, will shortly be determined. If the former, it can only proceed by entering and crossing the coal-field of the Zsil valley. If the latter, a branch could be constructed to the coal-field. The distance from Piski to the coal is about fifty miles, almost entirely in the valley of the Strehl.

Under any circumstances, therefore, this coal is likely to be

opened, and as it is the only known coal-field between the mouth of the Theiss and the Black Sea, and the railroad must pass through many large towns, there cannot be a doubt that the capabilities of the district may soon be fully tested.

In point of magnitude the Zsil coal-field is very much larger than all the other known coal-fields of Hungary put together. It is a regular basin, divided into two, or perhaps three, parts; but the upper extremity towards the mountains, which is very narrow, may be safely left out of the calculation. The whole basin of the main branch of the Zsil (which crosses the Carpathian chain, and runs southwards through Wallachia) has the coal cropping out round its edges, but the most striking crops are on the north-eastern side, near the point most accessible from the adjoining valley, up which the railway must come.

There are few unworked mining districts, where the facts of the case are so clearly disclosed by surface operations and natural crops, as in this district. The coal has been tilted by important upheavals all round, so that it dips heavily to the south on the north side and to the north on the south side, while on the east side it dips west, also towards the centre of the basin. The north-east and south-east angles are disturbed. The west end is detached, apparently by fractures and faults, and is less known and less important than the eastern part.

Almost the whole of the central part of the Zsil valley is covered with regular deposits, consisting of conglomerates, sandstones, and sands of newer date than the coal measures, and lying unconformably upon them. These form lofty and steep cliffs towards the river in many places, and in one valley have been very extensively worked for gold at former times. A diluvial gravel, obtained from them and from the mountains behind, has also been washed with the same object.

The coal measures crop out generally behind the conglomerate hills, or rather between them and the mountains on each side. They also appear in the principal side valleys, of which there are many. More than fifty distinct crops are seen, and many small adits have been driven in the coal to determine its nature and the circumstances of its occurrence. No borings have yet been made to prove the existence of the coal between the north and south lines of crop. Unless, however, the coal is much flatter in this part of the basin, it is either gone altogether or is quite inaccessible, as the dip is generally 39° or 40°, and often much more.

Thirteen seams of coal have been determined, of which four are about 3 feet thick, three 6 or 7 feet, one about 10 feet, and one is in many places from 40 to 50 feet in thickness. These seams are separated by sandstones and shales, and the total thickness of the measures may be estimated at 100 fathoms.

The crop of the thick coal is clearly proved on the north side for a distance of nearly seven English miles; and along this whole length it retains all its characteristic features. One of these is a peculiar fossiliferous roof. There are also a few small partings, which are generally in the same place in the seam.

It is a very remarkable and highly interesting geological fact,

that this coal of the Zsil valley is of tertiary age. It is, however, unmistakably a real stone coal and not a lignite. It is perfectly uniform in all essential features in all parts of the field. It is associated with hard sandstone, regular shale, and good ironstone bands. It bears exposure to weather for any reasonable time with even less injury than many of the best coals, and no one looking at it, without a knowledge of the fact ascertained from other evidence, could suppose that it was not palæozoic.*

The quality of the coal is as follows:—It is rather tender at the crop, but harder at some distance in the adit. Its colour and streak are black, or bright black. It has few shaly or slaty bands. It resists exposure to all weathers, winter and summer, without decomposing or disintegrating. It has little ash, and hardly any pyrites. It is rather light, very gassy, and burns very freely, with much flame. It cokes fairly, but has hardly been sufficiently tried to justify an opinion on this point. It contains no more water than ordinary stone coal, and less than the average of all the true coals of eastern Europe. It contains no water that can be removed by drying or roasting. The following tabular statement is deduced from the publication supplied by the Royal and Imperial Geological institution of Vienna for the Great Exhibition of 1862:—

	Water.	Ash.	Carbon.	Caloric unit.
Brown coal, average of all Austrian ..	15·50	9·00	—	4,168
Stone coals, " { 5 Fünfkirchen / 9 Bohemian }	2·60	7·40	67·60	{ 6,487 / 5,514
Zsil coal........................	2·10	6·50	57·80	5,582

Calcining Furnace for Calamine.

The last number of the "Revue Universelle" gives a drawing, from which the accompanying cuts have been taken, of a form of calcining furnace, used in the South of Spain, for the purpose of calcining calamine. (Fig 1) is a sectional elevation, and (Fig. 2) a ground plan.

On the Continent it is usual, in the case of calamine mines worked at a distance from metallurgical works, to submit the ore to a more or less complete calcination on the mine, with the object, principally, of concentrating the zinc contained in the ore in a considerably reduced bulk and weight, and thus reducing the cost of carriage. In operating on a moderately silicated ore, and in proper furnaces, the reduction in weight amounts to about 33 per cent., or one-third. The cost of carriage diminishes, of course, in the same proportion; and in Spain, where this item often amounts to one-half of the value of calamine delivered at the smelting-works, it will be at once perceived how important a saving of this kind becomes,

* Specimens of this and of the other Hungarian coals may be seen in the Great Exhibition among the Austrian products. They are exhibited by the Geological Institution of Vienna.

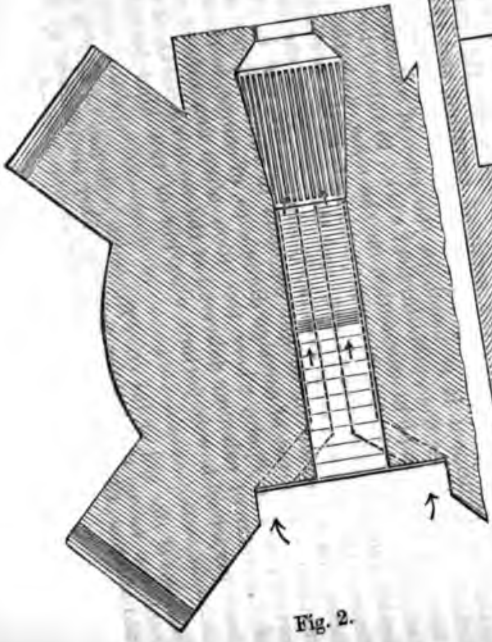


Fig. 2.

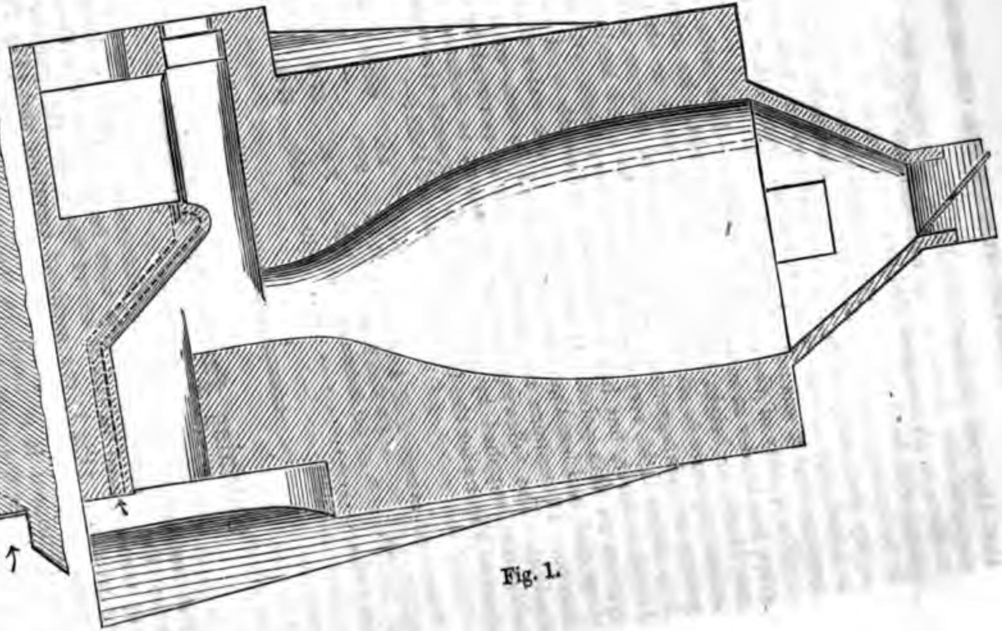


Fig. 1.

and what an interest the miner has in adopting every available means in the improvements of their calcining appliances.

In the south of Spain, MM. de Wissocq and de Ottero have introduced calcining furnaces of the form shown in the figures, of which the experience of several years has shown the excellent qualities, particularly for the calcination of calamine in blocks. With a mean consumption of from 8 to 9 per cent. of fuel, these furnaces, attended by six men, are capable of turning out every twenty-four hours as much as 10 tons of calcined calamine. The production of any furnace may be kept to the utmost, or it may be kept back, or even completely suspended for a week or more, without this interruption having any injurious influence on the resumption of the work,—which are great advantages in a country where the difficulty of transport, and the frequent irregularity of mining works, prevent a certain regular supply of material being provided for a length of time with any degree of certainty.

These furnaces being heated by the flame coming in laterally, there is a less loss of metal than in those where the ore and fuel are placed in layers; and besides, as the fuel is kept quite separate, and not mixed with the ore, the latter is saved from a mixture which certainly deteriorates it.

The furnace shown in the drawings slightly differ from those used by MM. Wissocq and de Ottero, inasmuch as there is only one fireplace, and one place for withdrawing the ore—directly opposite each other. It was erected for calcining, on the mine, calamine coming from only a small working. The body and the hearth are connected by a surface with a continued curve; hot air is introduced underneath; and, except the arching of a fireplace, all the furnace is built of limestone and sandstone.

The drawings sufficiently explain themselves to make any detailed description unnecessary. We may say, however, that during the calcination, it is necessary to keep the door for withdrawing the ore carefully closed.

An Improved Form of Shaking-frame.

CONSTRUCTED BY SENOR JOSE DE MONASTERIO, SPANISH ENGINEER.

IN the *Revista Minera*, Number 281, Vol. xiii, a short description is given of a new and improved form of shaking-frame, constructed at Bilbaina lead mines by Señor José de Monasterio.

Shaking-frames, or shaking tables as they have been often called, following literally the nomenclature of the Continent, are little known, and scarcely at all used in England. On the Continent they are well known, and largely used;—the *Stossheerde* in Germany and the *Table à Secousses* in France and Belgium, being met with in most large dressing establishments. A short description, and a drawing on a small scale, of this form of dressing apparatus will be found in Mr. John Darlington's paper, "Dressing of Ores," in Mr. Hunt's edition of Ure's Dictionary, Vol. iii, pp. 352—4.

In principle a shaking-frame or table merely differs from our ordinary English frame in being subject to a shaking or percussion motion, which largely aids the separating process. Our Cornish readers will best understand the principle when we say that it is that of the vanning-shovel on a much enlarged scale. It is rather difficult to understand why so obvious an application of the vanning motion to aid the effect of gravity and a current of water should be so wholly unknown in this country, particularly as it is found to answer so well on the Continent: there may be objections to it with which we are not acquainted, but our present impression is that the shaking-frame only requires to be known, and receive a fair trial, to be admitted as a useful adjunct to dressing certain classes of ores.

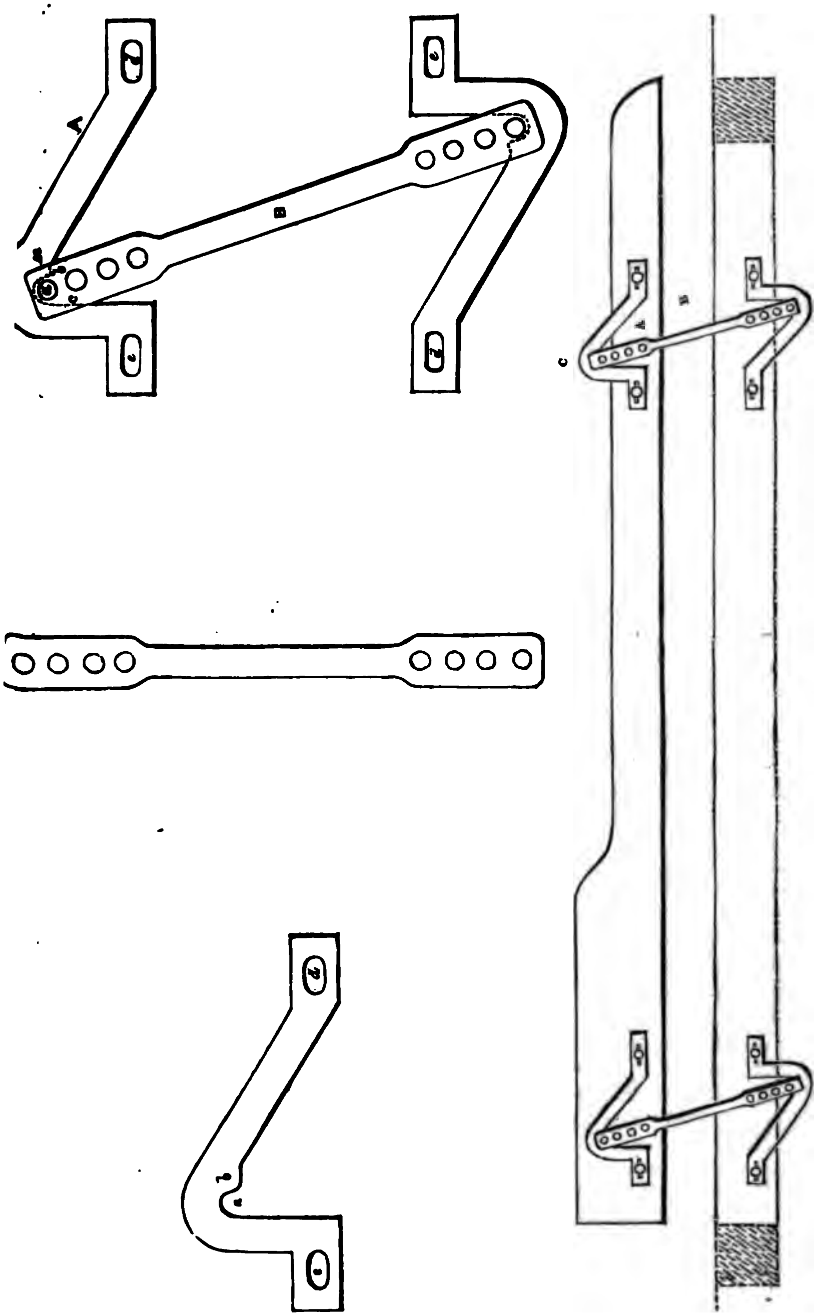
In the ordinary form of this dressing apparatus the frame is suspended by four chains—two at each end,—those in front being attached to a roller, so as to allow of the alteration of the inclination of the frame as required. An arrangement of this kind evidently requires a framing of timber above the frame itself, which interferes with its working, besides being clumsy and costly. In the arrangement of Señor de Monasterio, shown in the drawings on the opposite page, these chains, and the framing of timber to which they were attached, are done away with, being replaced by the short parallel bars, supporting the frame from beneath.

In all forms of shaking-frames a forward impulsion is first given to the frame, after which it is allowed to fall backwards by its own weight. In the arrangement in question this required motion is given by an eccentric cam, which in its rotary movement strikes the head of the frame, which then falls backward by its own weight, giving the movement required.

The drawings shown in the cut (the principal one of which is drawn to a scale of $\frac{1}{10}$th) sufficiently explain themselves to make a lengthened written description unnecessary. A are the four cast-iron stirrups, two on each side, by which the frame is supported by the parallel bars B, connected with the gudgeon C. The stirrups of the top and bottom are exactly the same in form, only reversed. A reference to the enlarged figures of these (drawn four times the size of the principal figure) shows that the place for the gudgeon *a* is bounded by an elbow *b*, to prevent the gudgeon slipping on that side. It will be also seen that these stirrups are connected to the frame and the supporting beam below by the oval openings *d e*, which form is adopted advisedly to allow a certain play.

The parallel bars have each four holes at either end, so that the inclination of the frame may be altered at will.

The working of the apparatus scarcely requires explanation. The frame receives its forward impulsion by the eccentric cam, and is moved about 14 inches forward, while the first of the gudgeons describes the arc *a m*: the frame then falls back by its own weight and that of the ore on it. It is found from experience that the arrangement of parallel bars in lieu of chains adopted by Señor de Monasterio adds greatly to the efficiency of the frame. This is easily understood, for it would evidently give more firmness and decision, so to speak, to the motion than would be the case where



chains are used. The inclination of the parallel bars should be such as to give them an "underlie" of about 8½ inches in their length.

At Balbaina these frames are used for dressing lead ores—both galena and the carbonates. It is found to answer excellently, and to allow of the profitable treatment of ores too poor to be operated on by any other means. The frames are attended by boys of from ten to twelve years old.

The ordinary form of shaking-frame, supported by chains, was evidently a clumsy machine, and would not find much favour among mechanics, however correct its principle might be. The substitution of parallel bars for these chains by Señor de Monasterio is so evident an improvement in every respect that we hope to see this form of dressing apparatus tried in some of our English mines. We are quite satisfied that, modified by experience, it will be found a most useful adjunct to our large dressing floors, particularly for the treatment of lead ores. Whether it would suit tin dressing we are not prepared to say.

Illustrated Notes on Prominent Mines.

By the Editor.

GREAT WHEAL FORTUNE.

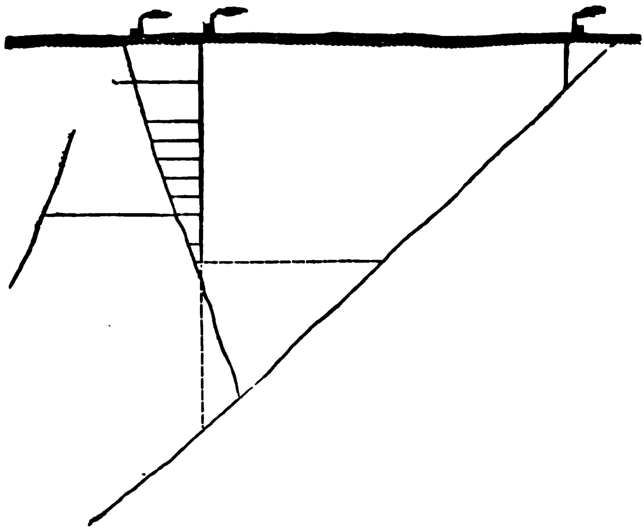
This mine is situated in the parish of Breage, in the county of Cornwall, on lodes parallel to those of Old Wheal Vor and of Wheal Metal (now worked under the name of Wheal Vor).

In geological position, this tin district occupies a killas basin lying to the east of the detached granite range of the Tregonning and Godolphin hills. The western part of Wheal Vor, called Carleen, was worked into this granite, but no tin of any consequence was ever met with in that rock on the Wheal Vor run of lodes. This is rather remarkable, as generally granite, above all others, seems to be the most congenial rock for that metal; and as the converse has been found to hold in the case of some parallel lodes further north, which, in Great Work mine, made rich in the same granite range of the Tregonning and Godolphin hills, but became unproductive in the killas. However this may be, the Wheal Vor and Great Wheal Fortune district is essentially a killas one, with the shoots of tin dipping east, that is away from the granite. This latter fact seems to be a regular law in Cornwall; for, where shoots of any metallic ore have any dip at all, they seem invariably to follow the inclination of the junctions of the granite with which they may be associated; where they are associated with elvans, they follow the dip of the elvan courses.

The present workings of Great Fortune are on two parallel lodes, about 250 fathoms apart at surface, forming two distinct mines. These workings are shown in a transverse section in the accompanying sketch (fig. 1), which is drawn to a scale of 100 fathoms to one inch. The Old or South mine is down, at Harvey's engine-shafts, to the depth of 95 fathoms below the adit, cross-cuts being extended

south from the shaft to the lode at the adit, the 20, 30, 40, 50, 60, 70, 85, and the 95, all of which are shown in the section. The lode at this mine, it will be seen, is a north underlyer, and, in the levels at present working, is split up into several branches, which are producing a fair amount of tin—about enough to pay the cost of this part of the working.

Fig. 1.



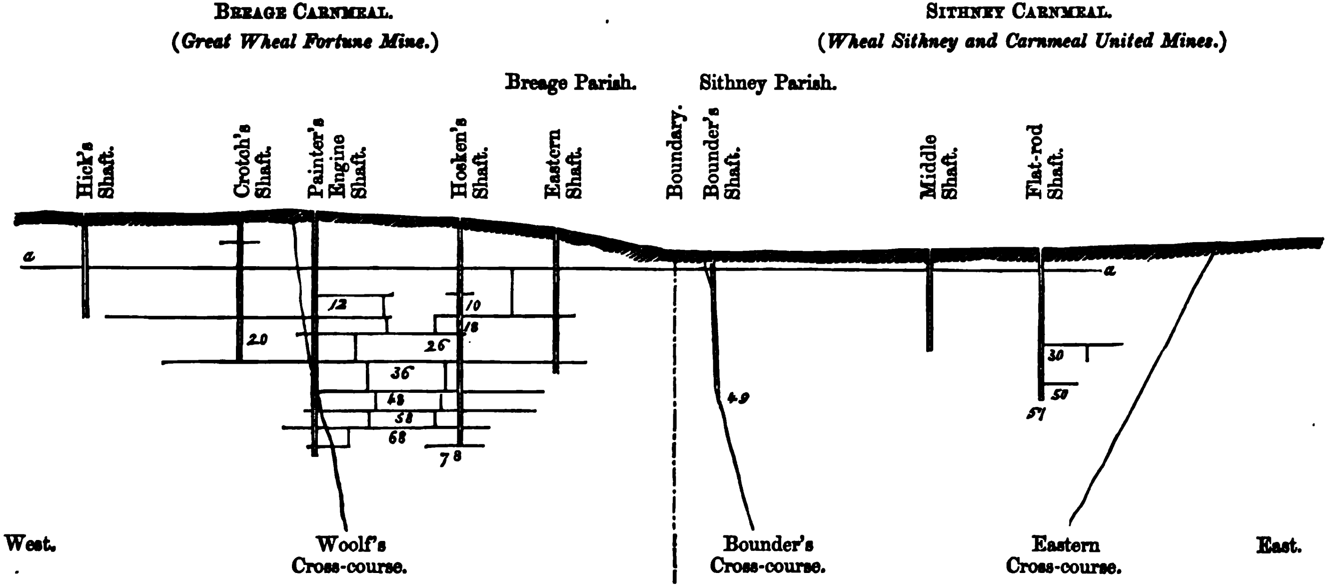
It will be remarked, that at the 70-fathom level a cross-cut has been extended south, and has intersected the Wheal Tug lode in about 80 fathoms driving: this lode, it will be seen, is a south underlyer.

The principal workings at present at Great Wheal Fortune are, however, at the North mine, which is wrought on a lode called the Carnmeal lode, a very rapid south underlyer. On this lode Painter's engine-shaft is sunk perpendicular to the adit (25 fathoms), below which it goes down on the course of the lode, as shown in the transverse section (fig. 1) to the 78-fathom level below adit. If the Carnmeal lode were to continue its present underlie, it would be reached by Harvey's engine-shaft at the Old mine at the depth of about 180 fathoms, or 90 fathoms below the present bottom, as shown by the dotted line in fig 1. It has been recently proposed to drive a cross-cut south from Harvey's shaft, at the bottom (the 95), to intersect this lode, which would be done in about 100 fathoms driving, and which would intersect the lode about 60 fathoms below the present bottom of the North mine: this proposed cross-cut is also shown by a dotted line.

The workings on the Carnmeal lode are shown in the longitudinal section on the opposite page (Fig. 2). The engine shaft (Painter's) is down, as stated, to the 78, below which level it is now sinking. East of Painter's shaft, 96 fathoms, is Hosken's shaft, also down to the 78, and on to the course of the lode below adit.

FIG. 2.

SECTION ON THE LINE OF THE CARNMEAL LODE.



In WHEAL VOR all the riches made between these Cross-courses, dipping east from the surface at WOOLF'S Cross-courses to the Eastern Cross-course at 4 feet per fathom.

Scale: 100 fms. to 1 inch.

Between this and the Sithney Carnmeal boundary is another shaft, called the eastern shaft, down to the 48, but not communicated to that level. West of Painter's there are also two other shafts, Crotch's, about 30 fathoms west, down to the 36, and the western shaft, about 50 fathoms again west of Crotch's, down to the level of the 20, but not communicated.

The levels between the shafts are best shown in the section. The finest tin ground yet met with on this lode has been between Painter's and Hosken's shaft in the two bottom levels communicated. The 68 especially has been a splendid level, having opened out ground in places worth, for some length, £100 per fathom, on a lode that can be taken away for 50*s*. The lode averages in the levels about 4 feet wide, of a most promising nature for tin, composed of peach and spar. Peach, which is a word used by the Cornish miners, in a generic sense, to denote all minerals of the chloritic family—and is consequently a very convenient word—seems to be esentially the "mother" of tin; but the experience of Cornwall goes to show that peach alone does not produce a permanent tin mine: an intermixture of quartz is necessary to give what miners call "strength" to the lode.

The underlie of this Carnmeal lode is rather remarkable, and has to some extent created a prejudice against it. The Great Wheal Vor main lodes underlayed north, and it was long a dogma of this district that a south underlayer would never make a mine. I need scarcely say that a wide experience of the county shows there is no foundation for this hypothesis. The extent of its underlie was a more plausible objection, for as a rule lodes with such a very fast underlie do not make very permanent mines: there are many exceptions however to this general rule, and the Carnmeal lode seems to be one more. It is worthy of remark, however, that where the lode is richest, the underlie is not so great; and it is doubtful whether in depth it will continue to dip so much as it has done from surface to the present bottom.

The section (Fig. 2) also shows the workings, in the adjoining sett of Sithney Carnmeal, on the Carnmeal lode. In this sett there is also an old mine to the south, Wheal Sithney, which is on the same lodes as the South mine of Great Fortune. The recent re-working of this old mine has been a failure, which is scarcely to be surprised at considering the result of the workings on the same lode in Great Fortune.

Figure 2 also shows that these two setts are traversed by the three leading cross-courses of Wheal Vor, between which the great courses of tin made in the that mine. This mine, as most my readers probably know, was the richest ever known in Cornwall, having returned, I believe, as much as 140 tons of block tin per month, or twice as much as is now returned by Dolcoath.

Wheal Metal mine, 300 fathoms to the north of the Carnmeal lode, and now working, as I have said, under the name of Great Wheal Vor, although it is rarely wrought on parallel lodes some hundreds of fathoms to the south of the Old mine, has produced the richest courses of tin met with in Cornwall in recent times, although neither its returns or profits have somehow or other been in propor-

tion to the productiveness of the lode. To the east of this, Sithney Wheal Metal is worked by a private party, and is soon expected to reach the rich tin ground of its neighbour.

Altogether this tin district, which has been the richest in the county of Cornwall, is one of great interest. It is to be hoped that it may again prove as productive as it did in former days.

Abstracts and Reviews.

THE *REVUE UNIVERSELLE.*

Revue Universelle des Mines, de la Métalurgie, des Travaux Publics, des Sciences et des Arts, appliqués à l'Industrie, sous la direction de M. Ch. de Cuyper, Professeur Ordinaire à la Faculté des Sciences de l'Université de Liége. Sixth year, 2nd livraison, March and April, 1862. Paris and Liége, E. Noblet, à Paris, rue Jacob, No. 20.

This number of the *Revue Universelle* contains the following papers:—

1. Théorie de la Trempe, par C. E. Jullien.
2. Notice Descriptive d'un Projet de Fabrication des Bouches à feu en Acier fondu, par François Bertrand.
3. Eclairage au Gaz. Translated from Mr. Samuel Hughes' papers in the *Mechanic's Magazine.*
4. Appareil à Chauffer l'Air en utilisant les Gaz perdus des hauts-fourneaux, par W. Bussius of Brunswick. Abstracted from the *Berg-Hüttenmännische Zeitung.*
5. Emploi du Marteau-pilon pour la confection des petites pièces. Abstracted from the *Mechanic's Magazine.*
6. Chaudières et Machines à Vapeur. Abstracted from the *Mechanic's Magazine.*
7. Parachute à Friction pour Cages des Mines, Monte-charges, &c., par Frédéric Nyst.
8. Fours de Calcination pour la Calamine.
9. Nouvelle Méthode pour suspendre les Tables à Secousses, par José de Monastrerio. Abstracted from the *Revista Minera.*
10. Notice sur la Fabrication des Rails d'Acier, et des Plaques d'Armure, par M. John Brown.
11. Mineralogical Abstracts:—On some Minerals from Chile, by Fred. Field. Abstracted from the *Quarterly Journal of the Chemical Society.* On Darwinite, by David Forbes.
12. Revue économique, administrative, et juridique des Mines et de la Métallurgie Françaises, par L. Simonin, Ingénieur Civil des Mines.
13. Revue des Sociétés Savantes de France et de l'Industrie Françaises, par André Boucard, Ingénieur Civil.
14. Bulletin.
15. Bibliographie.

These form a valuable series of articles—two of which we have abstracted; and although many of them are from English sources, the whole cannot fail to be interesting to English readers. The first article—on the theory of the tempering of steel and iron—treats on a subject of vast importance but considerable obscurity; and treats it with great ability, although M. Jullien's views will have yet to be received as to some extent hypothetical. Still, although we may not be so ready to accept M. Jullien's conclusions as he may wish, we must all admit the importance of his

inquiries, and the zeal with which he has pursued them, this being the sixth time he has come forward with his theory, which, says he, "*nous le pensons, ne sera pas la dernière.*" M. Jullien's memoir is not completed in this number; when it is completed we will endeavour to give an asbtract of it, if it can be satisfactorily done in a small compass.

The memoir of M. Bertrand, late a Student at the Industrial School of Liège, but now employed at the Steel Works at Truvia, Spain.—"On the Manufacture of Cannon from Cast Steel," will be read with interest at present, for the author seems thoroughly to understand his subject. The paper appears to be sound and practical, and many of the conclusions are evidently derived from experiments; but it seems we are only to regard it as a summary of his projects, introductory to more full descriptive details. His general views are, that untempered cast-steel is superior in tenacity and durability to any of the other siderurgic products, or to bronze, while the cost of cast-steel guns, rifled and entirely finished, scarcely reach 50 per cent. of the cost of bronze guns of equal weight and calibre. Consequently he holds cast-steel to be the cannon-metal *par excellence*, either for smooth bore or rifled artillery. If the trials made up to the present time have not always been satisfactory, may not this, he asks, be attributed to faults in the proportions, or to defects in the manufacture; the latter supposition is probable, for the manufacture is one of yesterday. M. Bertrand finally expresses an entire conviction that all difficulties will be surmounted, and that cast-steel artillery will successively replace all others.

The "Economical Review," by M. Simonin, will, however, probably be found by many the most interesting. The discussion of the position of the iron industry of France as affected by the Treaty of Commerce, is full of important matter. The relation of the mineral industry of France to the State is also freely discussed; and gives us some notion of the annoyances, often almost intolerable, which the system of bureaucratic centralization coupled with constant interference, entail on the mineral industry of that country. We recommend those who are crying for Government interference in this country to read this article, and see the effects of it in other countries before they fix it upon us. Fortunately, however, for the mineral industry of France, the Emperor seems fully alive to the evils which are entailed by the system of administrative interference which has gradually grown out of a very slender basis of legislation. M. Simonin heads his paper with the following quotation of the words of the Emperor:—

"*Il faut affranchir notre industrie de toutes les entraves intérieures qui la placent dans des conditions d'infériorite: aujourd'hui nos exploitations sont gênées par une foule de règlements restrictifs.*"

In M. Boucard's paper there is matter of much interest, particularly an abstract of certain observations by the veteran geologist, M. Fournet, on the Theory of Veins—M. Fournet maintains the Veins are due to igneous injection, and endeavours to answer the principal objections advanced against that theory.

COTTA'S *GANGSTUDIEN.*

Gangstudien, oder Beiträge zur Kenntniss der Erzgänge. [Vein-studies, or Contributions to the Knowledge of Ore-veins.] Edited by Bernard von Cotta, Professor of Geognosy at the Royal Saxon Mining-School of Freiberg, and Herrmann Müller, Royal Saxon Mine-Assessor at Freiberg. Freiberg: J. G. Engelhardt.

THE Germans have, for three or four centuries, occupied a foremost position as metallic miners. For two centuries, indeed, they stood pre-eminent in Europe, and were sought for in every country as instructors in the art of

searching for metallic deposits. So wise a sovereign as Queen Elizabeth, acting on the advice of her council, sent, in the third year of her reign, to Germany for some experienced miners to explore the mineral districts of England and Wales; and upon their arrival granted them a monopoly of all the mines in Wales and eight English counties. Later on, in 1565, all the mines and minerals in the remainder of the kingdom, and the English pale in Ireland, were granted to another German copartnery; so that at this time, as Mr. Hunt says, "All the mining operations of the kingdom were, with the exception of the tin and copper mines of Cornwall, and perhaps the lead mines of Derbyshire, under the direction of, if not actually worked by, German miners." Indeed a "Dutch Mineral Man"—as a German miner is frequently called by the old writers—seems to have been as recognised a necessity, in that day, for all mining matters, as an English groom is held to be on the Continent at the present day in all horse matters. That this state of things lasted down until late in the last century, and that some of these German immigrants were as doubtful in character as our own modern "bal-sellers," is shown by Sir Walter Scott's character of Dousterswivel in the Antiquary.

If the superiority of English mechanical appliances—particularly the pumping engine,—our greater capital and industrial energy,—and above all our freedom from constant Government meddling,—have given us the leading position as practical miners, and made English agents and miners sought for in every quarter of the globe, we must cede to our German brethren the honour of still holding the lead in mining literature. While Germany teems with periodicals devoted to mining and metallurgy—many supported by the various Governments. and others maintained as private speculations—there is nothing of the kind existing in these kingdoms except our own *Magazine*. Even the publications of the Geological Survey devoted to economical or mining matters seem to be gradually ceasing: they are certainly much less numerous than in the days of Sir Henry De la Beche.

The publication of *Gangstudien* commenced about 15 years ago. Its object was to collect together, in a compass devoid of all extraneous matter, the completest statement possible of our knowledge on metalliferous veins: seeking above all to collect facts, but still not excluding theoretical speculations or criticisms on them. Under the editorship of Professor Cotta, a name of European reputation, with whom Herr Müller has been recently associated, three complete volumes have already appeared, of which the following are the contents:—

VOL. I.

1. *C. G. A. v. Weissenbach.* — Ueber Gangformationen vorzugsweise Sächsens. Ein Fragment.
2. Bemerkungen des Herausgebers zu vorstehenden Aufsatz.
3. *B. Cotta.*—Allgemeine Betrachtungen über die Bildung der Erzgänge.
4. *H. Müller.* — Die Erzlagerstätten nördlich und nordwestlich von Freiberg.
5. *W. Vogelgesang.*—Die Przibamer Erzniederlage.
6. *Elie de Beaumont.*—Translation of his "*Notes sur les émanations volcaniques et metallifères.*

H. Müller.—Collectaneen der Literatur über Erzlagerstätten.

VOL. II.

1. *B. Cotta.*—Erzgangbildung in der Sohle eines Flammofens.
2. *W. Vogelgesang.* — Die Erzlagerstätten südlich und südöstlich bei Freiberg.
3. *H. V. Oppe.*—Die Zinn- und Eisenerzgänge der Eibenstocker Granitpartie.

4. *Robert Richter.*—Ueber die Darstellung künstlicher Mineralien.
5. *B. Cotta u. Fröger.*—Die Bildungsreihen der Mineralien in Gängen und Drusen.
6. *B. Cotta.*—Kurze Uebersicht der Lehre von den Erzlagerstätten.
7. *Esquerra del Bayo.*—Die Bergwerke von Heindelencina in der Provinz Guadalajara in Spanien.
8. *H. Müller.*—Ueber die Erzgänge des Grubendistriktes von Culera in Catalonien.
9. *H. Müller.*—Pseudomorphosen von Erzgängen.
10. *Delesse.*—Ueber das Vorkommen und die Gewinnung des Goedes in Australien (Abstract from the *Annales des Mines*).

Brief Notices.—E. Scheilden—Einwirkung des Nebengesteins in einer mexikanischen Grube.—*A. Breithaupt*—Ueber das ursprünglich gangartige Vorkommen des grössten Goldklumpens.—*Raf. Hofmann.*—Ueber Eisensteingänge bei Ruszkberg in Siebenbürgen.

Abstracts.—Continuation of *H. Müller's* Collectaneen.—Abstract of *Helmersen's* Reise am Altai.

Vol. III.

1. *H. Müller.*—Der Erzdistrikt von Schneeberg im Erzgebirge.
2. *F. C. Freiherr von Beust.*—Ueber die wahre Bedeutung der sogenannten Erzlager bei Schwarzenberg.
3. *Lan.*—Lagerstätten von Glasurerz in Frankreich.
4. *F. C. Freiherr von Beust.*—Das Vorkommen des Goldes in Sachsen betreffend.
5. *C. Cock.*—Ueber das Vorkommen von Nickelerzen am Westerwald.
6. *H. Müller.*—Ueber die Beziehungen zwischen Mineralquellen und Erzgängen im nordlichen Böhmen und in Sachsen.
7. *O. Leiber.*—Der Itacolumit, seine Begleiter und die Metallführung desselben Nebst Nachtrag.

Brief Contributions.—*O. Leiber.*—Ueber das Goldvorkommen in Nord Carolina.—*J. B. Kleinschmidt*—Ueber Erzgänge bei St. Louis in Nord Amerika.—*O. Leiber*—Goldlagerstätten in Carolina und Columbia.—*Dr. Genth*—Ueber Goldablagerungen.

Some of these memoirs must be classed among the most valuable contributions we possess on metalliferous deposits. Among the most important, we may name Herr Müller's memoirs "On the ore-deposits to the north and north-west of Freiberg," in Vol. I, and "On the ore-district of Schneeberg in the Erzgebirge," in Vol. III; Herr von Vogelgesang's papers "On the ore-deposits of Przibram," in Vol. I, and "On the ore-deposits, south and south-east of Freiberg," in Vol. II; and Herr Oppe's memoir "On the tin and iron veins of the Eibenstock granite," in Vol. II, which posesses a peculiar interest as showing the mode of occurrence of tin in one of the few localities in Europe, out of Cornwall and Devon, in which it is found commercially available. Professor Cotta's own paper—"Die Lehre von den Erzlagerstätten"—have since appeared in a separate volume, and in that form have now reached a second edition. Herr Oscar Lieber's paper, under the head of "Der Itacolumit," gives us by far the most complete description we possess of the gold formations of the Southern States of North America, which were referred to in Mr. Warington Smyth's paper in our last number as being probably more like those found occurring in Wales than any others we are acquainted with.

The great metallic mining districts of Germany are only second in importance and permanence to those of Cornwall, over which they possess the advantage of being more fully and accurately described. Really deep, and consequently permanent metallic mining districts are most rare, although rich, but irregular, shallow deposits of the metallic ores are very widely

spread. Our own impression is that the deep-making and comparatively regular ore-producing districts of Cornwall, and some parts of Germany, will see out all these rich shallow deposits; and consequently their careful study seems a matter of the highest importance. Above all, a comparison of the conditions under which ores occur in Cornwall and in the great German districts—points sufficiently removed to show the distinction between mere local phenomena and others capable of leading to the establishment of general laws—seems most essential. Such memoirs as those of Müller and von Vogelgesang afford us the means of doing this. In order to make them accessible to the ordinary English reader, we shall give abstracts of them from time to time.

MR. HULL ON THE DISTRIBUTION OF THE CARBONIFEROUS STRATA IN GREAT BRITAIN.

On Iso-diametric Lines, *as a means of representing the* Distribution *of* Sedimentary Clay *and* Sandy Strata, *as distinguished from* Calcareous Strata, *with special reference to the* Carboniferous Rocks *of* Great Britain. By Edward Hull, B.A., F.G.S., of the Geological Survey of Great Britain.

(Abstracted from the Quarterly Journal of the Geological Society.)

"*Introduction.*—A large and interesting field of inquiry is open to us in comparisons of the relative distribution of the calcareous and the truly sedimentary members (using the term 'sedimentary' to denote exclusively such inorganic strata as sandstones, clay, shales, &c., in opposition to calcareous strata or limestones) of different geological formations. We have, as it appears to me, been too much in the habit of classing limestones (whether coralline, crinoidal, shelly, or oolitic), as strictly sedimentary; yet it will be found, by such comparisons as those alluded to, that the relation which is borne by sandstones and shales to limestones is one, not of similarity, but of contrast. In other words, that where we have a group of strata, as, for example, the Lower Carboniferous, composed partly of 'sedimentary' and partly of calcareous members, it will generally be found that the one series is complemental of the other, and developed from opposite directions. This arises from the differences in the origin of the two classes of stratified rocks—the calcareous being essentially organic, and the 'sedimentary' essentially mechanical; so that where the forces and agencies tending to the accumulation of the latter are in active operation, these very forces and agencies are in direct antagonism to the other, and, as a result, calcareous strata are either not formed or only sparingly.

"Of these two ever-acting principles we have numerous examples both in recent and in geologic periods. If we take as an illustration the Gulf of Mexico and the West Indian Islands, we find the sediment brought down by the Mississippi forming deposits of sand and clay which are spread along the coast and far out to sea by the Gulf-stream, while around the West Indian Islands coralline limestones are being accumulated in a clear ocean. If we take the North Atlantic, we find reason for believing, on the evidence of the deep-sea soundings, that the central sea is composed of a fine calcareous mud, the production of *Foraminifera* and other marine animals, while along the shores of the American continent and those of Europe deposits of sand, gravel, and clay are in course of accumulation. If these regions were elevated into land, we should probably find a formation composed in one direction of limestone, like chalk, and in the other of sandstones and shales, both classes of material being developed from opposite areas of dispersion.

"The same general principle is in force over our globe at the present day, and probably has been from the times when calcareous strata, which

are the representatives of marine life, first began to be formed. Wherever large rivers pour sediment into the ocean, or where currents take up and distribute this sediment over the sea-bed, there limestones will be very sparingly formed. On the other hand, where, from certain causes, such as the great distance from land, or the absence of such rivers and currents, the water of the sea is *clear* and *free from mud* within the temperate or tropical regions, there calcareous matter will be accumulated. Of the strata at present forming, the great calcareous members are to be found occupying principally mid-oceanic regions, and their representative sedimentary members range themselves in the direction of the coasts. Still there may be frequent cases where the limestones may be formed along the coasts of large tracts of land, as on the shores of Australia and Southern India, but in every such case there is an absence or scarcity of sandy or muddy sediment."

Mr. Hull here gives various examples of geological formations changing their types of mineral constitution from the calcareous to the sedimentary, evidencing the different conditions of deep clear pelagic waters on the one hand, and turgid litoral waters on the other. He gives the instances of the White Chalk of Europe, which in America is replaced by sandstones, shales, and lignite, in which there is very little calcareous matter; the Great Oolite as it occurs in Oxfordshire, where it is essentially organic in its composition—and as it occurs on the east coast of Yorkshire, where it has become almost wholly "sedimentary;" the Permian Rocks of England, at the opposite extremities of whose area a maximum development of calcareous and sedimentary elements are formed; and, finally, the Lower Carboniferous Rocks of Belgium and Westphalia, where the great development of Carboniferous Limestone, underlying the coal-measures in Belgium disappears in Westphalia, where it is replaced by sandstones and shales, resembling the Lower Carboniferous series of Scotland.

"Similar illustrations might be multiplied, did space permit; but, without here entering further into the general principle, I will merely state my belief that a comparison of the relative distribution of the calcareous as distinguished from the argillo-arenaceous, or sedimentary, strata of the Carboniferous, Devonian, and Upper Silurian formations would show, as a general rule, that the regions of maximum development of the one series are those of minimum development of the other, and, consequently, that the relationship of the two classes of rocks is complemental.

"I have already hinted at the cause of this inherent distinction, but it may be as well to state it in more precise language. As limestones are, by universal consent, allowed to have resulted from the exuviæ of living animals, they will be accumulated in greatest quantity wherever the conditions of life are most favourable. Now, the fact that limestones, when they occur in considerable thickness, are generally pure and free from foreign matter, shows that one of the first requisites for limestone-making animals is that they should inhabit waters free from mud or sand. Where the White Chalk is in greatest thickness, it is pure; the same is the case with the Oolite Limestones, and with the Carboniferous Limestone of Derbyshire which is of enormous thickness and contains very few beds of shale; but, whenever these massive calcareous rocks begin to be split up by the admixture of shales or sandstones, they become impoverished in mineral character and diminished in thickness.*

"There is one objection which may be urged against this view of the

* The limestones of the Culm of Devonshire, as compared with their representatives at Bristol, are illustrations of this principle. At Bristol, where it occurs in great force, the limestone is pure and crystalline; but in Devonshire, where black shales are largely distributed amongst the beds of limestone, these latter are frequently of so poor a quality that "even in the richer portions there

relations of true sedimentary and the calcareous strata. In the cases just cited of the Carboniferous Rocks of Belgium and Westphalia, and of the Great Oolite of our own country, the development of the sandstones and shales from the one direction, and of the limestones from the opposite, are not strictly contemporaneous. Thus the lower and upper sandstone and shale of the Great Oolite, which are thickest in the North, are earlier and later than the "white limestone," which is most highly developed in the South. This, however arises from the very slow progress of those changes in the character of the land and sea which have conduced to the differences of the strata formed in each district. While the lower series of sandstones and shales were being formed over the Yorkshire area, the sea-bed was gradually preparing for the future development of calcareous strata over the Oxfordshire area; and while limestones were forming under Oxfordshire, the sea of Yorkshire was still sufficiently charged with sand and mud to prevent their full development in that quarter. Another change occurred; the Yorkshire sea again became charged with sand and mud, which so far extended its influence to Oxfordshire as to check the formation of pure limestone.

"In this instance, as in others, there was a series of oscillations as the two agencies alternately predominated; but, while each in turn obtained the ascendency, the influence of the other never entirely ceased within certain limits. Thus, while sandstones and shales were accumulating in Yorkshire, sandy limestones and calcareous shales were forming in Oxfordshire, as the influence of the calcareous element was always more or less in force in the southern direction, when it was entirely overpowered by the ascendancy of the sedimentary element in the north. And if we adopt the conclusion of Bischof, that it is impossible for any carbonate of lime to be precipitated at the bottom of the open sea by chemical action, but only by the intervention of organized beings, we must allow that these agencies, by whatever terms they may be designated, are not mere figures of speech, but real and ever-acting forces of nature."

Regarding, then, the calcareous strata as differing in their origin and in their mode of distribution from the other stratified rocks with which they are associated, it appears to me that it is incorrect to class them together under the same term of "sedimentary," I therefore propose to eliminate the limestones from this category, and to place them as a distinct class of rocks, confining the term "sedimentary" to gravels, sandstones, shales, and clays, with their variations. The presence of each class of rock in the same geological group is no argument in favour of their similarity. Whenever interstratifications occur, they may be regarded as occupying the neutral ground between their respective areas of dispersion; and I have little doubt, could it be possible to trace the sources of the "sedimentary" strata of any formation on the one hand, and of the limestones on the other, they would be found expanding in opposite directions, and, as it were, originating at opposite poles. The relationships here contended for will be rendered more clear in the case of the British Carboniferous Rocks by the iso-diametric lines presently to be described.

"*Cause of the frequent occurrence of a Threefold Arrangement in Groups of Rocks, with a central Calcareous Member.*—We cannot fail to have observed that many groups have a tendency to arrange themselves into threefold divisions, the upper and lower being composed of sands or clays, the middle of limestone. This has been remarked, as the result of his observations on the continent by Sir R. Murchison, and we have many examples in this country. Thus, in the Upper Silurian Rocks, there is a calcareous

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is seldom more than a third or fourth part which is actually burnt for lime." —See "Memoirs of Sedgwick and Murchison, in Geol. Trans.," 2nd Ser., Vol. v, p. 674.

centre. This is also the case in the Devonian groups of Devon and Cornwall ; in the Carboniferous, the Permian, the Triassic (when complete), and the Jurassic Rocks.

"Phenomena of so general a character cannot be accidental, but must be in accordance with the system of nature. May not the following be the true explanation ?

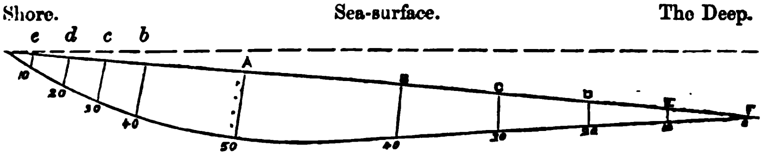
"We may consider a group of rocks as primarily representing three periods: the first of movement, the second of quiescence, the third of movement again. We have already seen that the formation of calcareous strata depends mainly on the absence of sandy or muddy matter in the sea, which we may believe most likely to occur during a long period of repose from oscillations of land, as every movement of that kind would tend to increase the quantity of sediment poured into the sea. Hence we have the following parallelism in the three stages :—

"Upper stage	*presenting*	movement	*resulting in*	sedimentary strata.
"Middle stage	"	quiescence	"	calcareous strata.
"Lower stage	"	movement	"	sedimentary strata.

"The movements of the introductory stage have generally been more powerful than those of the closing stage ; and thus, while we seldom or never find a Geological Epoch introduced with the formation of limestones, we sometimes find limestones maintaining their position to the close, as in the case of the Clymenia-limestone of the Upper Devonian of the Rhine, and in the Upper Silurian group of North America. The earliest stage is generally formed of sandstones and conglomerates, representing those physical changes which introduced the new epoch.

"*Iso-diametric Lines.*—We may regard all formations composed of sedimentary materials, as exhibiting in cross-section a figure included by the arc of a curve and its chord (Fig. 1). The end of the figure, which tapers more rapidly will represent the shore, the other the sea-deep ; and the form of the figure will be variously modified by circumstances. The thickest or deepest portion will be *not at the centre*, but between the centre and the shore.

Fig. 1.—*Diagram representing the Primary Section of a Formation.*



"Now, if we divide this figure by a series of lines (A, B, C, &c., and *a, b, c,* &c.), each decreasing by the same amount, and trace these lines over the region occupied by the formation, each will be a sort of stratigraphical contour; but, instead of representing equal altitudes, will show equal thicknesses. As such, these lines should properly be called *iso-picthic ;* but this word is so difficult of pronunciation that I prefer the term *iso-diametric*, or simply *isometric*. Such lines are not intended to show the present or actual thickness of the strata, which may have been in part denuded, but the *original development before denudation,* and may thus be traced over areas where the whole has been swept away. In tracing out such lines, it is necessary to make accurate comparisons of sections scattered over the entire area, and of the original thickness of the strata which are either par-

tially or altogether denuded, estimated upon certain definite principles. Of such principles *the development of calcareous and 'sedimentary' strata from opposite directions* is one of the most important.

"It will be perceived that isometric lines may be used in representing the thickness of an individual stratum, as well as of formations, groups, or systems; and the chief point to be attended to in tracing them is that the calcareous elements be eliminated from the 'sedimentary.'

"In the case of 'sedimentary' strata, a series of isometric lines, each representing an equal increase or diminution in thickness, will become nearer or wider apart as they approach or recede from the centre of maximum development.

"In the case of calcareous formations, the focus or centre of maximum development will be at opposite points to that of the 'sedimentary' in the same groups or system of rocks, and the isometric curves will intersect, gradually diminishing in force from their respective centres, just as a series of waves propagated from two centres of disturbance cross each other and gradually die away in opposite directions.

"*Carboniferous Land-surface of Central England.*—Having thus explained the nature of isometric lines, we proceed to consider their application to the Carboniferous Rocks of Britain. I believe they will be found of essential service in bringing clearly and intelligibly before the eye several phenomena connected with the distribution of the sedimentary as compared with the calcareous portions of this group.

"It is necessary that a few words should be said in reference to a point of interest in the physical geology of our island, which should be clearly understood before treating of the distribution of the Carboniferous Strata. I refer to the existence of a barrier of land which there are grounds for supposing to have stretched from Wales eastward, skirting the southern ends of the South Staffordshire and Warwickshire Coal-fields, and including the Cambrian Rocks of Charnwood Forest. The evidences for the existence of this land-surface I cannot here stop to point out in detail, having already done so elsewhere;* suffice it to say they are numerous and satisfactory, both on general physical grounds and from phenomena observed in the mines of the coal-fields on approaching its borders. This barrier (which possibly was an extension of the Scandinavian promontory on the one hand, as very clearly indicated by Mr. Godwin-Austen, and thence stretched across the Irish Sea to embrace the Cambro-Silurian districts of Wicklow and Carlow on the other) divided the Carboniferous Rocks of South Wales, Somersetshire, and Dean Forest, from the coal-tracts of central and northern England and Scotland; and, as we shall see, the strata on each side belong to two distinct systems of distribution, and are due to two different sets of oceanic currents.

"I. Region North of the Barrier.

"*South-easterly attenuation of the 'Sedimentary' Strata; North-westerly attenuation of the Calcareous Strata.*—If we take a series of vertical sections of the various sandstones, grits, and shales of the Carboniferous Period, from the midland counties of Leicester, Warwick, and South Stafford, then through the adjoining districts to the north, and ultimately into Scotland, we shall find a constant accession of material along this course. Thus, I find that the increase from Leicestershire to Lancashire, along a line running north-west, is no less than 8,000 feet of strata in a horizontal distance of 65 miles, which gives a slope of 1 in 43, or about 1° 30′ as the angle of increment of sediment in this distance; the maximum thickness of the strata in Lancashire being 12,000 feet, and in Leicestershire 4,000 feet.

* "The Coal-fields of Great Britain," 2nd Edit., p. 246, *et. seq.*

"If, on the other hand, we make a similar series of sections of the limestones, from Derbyshire as a centre, either west, north-west, or north, we shall find that these calcareous strata constantly diminish in thickness in these directions. In other words, the limestones become thin as the sandstones and shales become thick.

"We may thus regard Derbyshire as a focus of activity from whence the calcereous elements have been propagated with constantly diminishing intensity, at least in the directions here stated. Whatever be the extreme thickness of the Derbyshire limestone, it is apparently not less than 5,000 feet, as determined by several measured sections of the Geological Survey,—a bulk of calcareous matter truly astonishing when we regard it in its true aspect as the work of marine animals. Nowhere else in Britain does the formation attain such vertical dimensions; but they may possibly be less than those which it reaches in the Rocky Mountains and elsewhere. Traced northwards into Northumberland and Scotland, the limestones, as is now well known, dwindle down in thickness as they become more and more mixed with transported sediment, and in Lancashire appear on the point of expiring.

"Traced southwards, the limestone ends against the shelving shore of the old land-surface of the barrier, as at Charnworth Forest; or is altogether absent as in South Staffordshire, on account of this district having been above the sea, as shown by Mr. Jukes.* From this old land, however, little or no sediment was given off, as the limestone attains a very great thickness, and is pure dolomite at a short distance from the present site of the Cambrian rocks. Over Derbyshire the sea must have been remarkably clear; but it became more muddy northward, till in Scotland the sediment was so abundant as to extinguish life in the Crinoids and Corals, by whose labours the limestone was formed. *Hence we have a clear proof that the sources of the sediment were in the north.*

"In Yorkshire these variations in the relative distribution of the calcareous and non-calcareous strata of this group have long since been pointed out by Professor Phillips. In a diagram appended to 'The Geology of Yorkshire,' these variations are represented by an ingenious design, 'and prove,' as the author remarks, 'that the agencies which resulted in the formation of the limestone acted with greatest effect from the south-east, while those which resulted in the deposition of sandstones and shales acted with greatest effect of the north-west.'

"He then proceeds to trace the range of the lower Scar-limestone, showing that towards the south-east of its course, between Ribblesdale and Wharfedale, it is 1,000 feet in thickness. Northward at Pen-y-ghent it is about 600 feet; at Kirby Stephen even less. North of the line from Kettlewell to Bar Fell it becomes split up by beds of shale, grit, and coal, which continually augment northwards, until at length it assumes all the characters of the Lower Carboniferous group of Scotland.

"He then shows that the Yoredale series increases in thickness towards the north-west (that is, in the direction along which the limestone becomes attenuated), attaining at Bar Fell 1,000 feet or more, and dwindling down to 300 feet under Great Whernside.

"These passages describe changes in the Lower Carboniferous series of Yorkshire, which are applicable on a much wider stage to England and Scotland, from the edge of the barrier northwards. Had Professor Phillips extended his observations, and followed out the train of thought upon which he had entered, I can well understand what a fund of illustration and force of reasoning this subject would have received at his hands."

In the Map accompanying the Memoir in the *Quarterly Journal*, Mr. Hull indicates, by the isometric lines, the thickness of the Carboni-

* "Memoir on the South Staffordshire Coal-field." 2nd Edit.

ferous Limestone over every part of Britain; these thicknesses having been obtained from the carefully measured sections of the Geological Survey, so far as it has extended, and from various other sources for the northern districts of England and for Scotland. Thus, the thickness of limestone in Coalbrook Dale is 50 to 100 feet; in Denbighshire, 1,000 to 1,500 feet; in Flintshire, 1,000 to 1,500 feet; Anglesea, 360 feet; south side of the Lake District, 1,500 feet; Scottish Borders, 500 feet; and the Lothians, 162 feet. In Lanarkshire it is less, and in Fifeshire it is on the point of expiring.

As in the Map the thickness of the calcareous strata is shown by one set of isometric lines, so the development of the "Sedimentary" strata—grits, sandstones, and shales—of the Carboniferous Period is shown by another set of isometric lines, laid down from information collected from the most reliable sources. Mr. Hull goes *seriatim* through the principal carboniferous localities of Britain north of the barrier:—*South Staffordshire*, the *Warwickshire Coal-field*, the *Leicestershire Coal-field*, *North Staffordshire*, *Flintshire and Denbighshire*, *Anglesea*, *Notts*, *Derbyshire*, *and Yorkshire*, *Lancashire*, *Cumberland*, and *Scotland*. In each of these he shows the extent of "sedimentary" strata, and discusses the probable conditions under which it was deposited. In Lancashire there is a greater development of Carboniferous sedimentary strata than in any district in England—reaching a thickness of 12,200 feet, 2,200 feet greater than North Staffordshire, and 8,750 feet greater than Warwickshire. In Scotland, however, as compared with their representatives south of the border, it seems probable, from the substitution of stratified shales, sandstones, &c., for limestones in the lower portion, that, when the whole series was originally deposited, the sedimentary portion attained a development unsurpassed in any other district in Britain. From the vast quantity of strata removed by denudation we have no means of judging the thickness of the Upper Coal series. The "Flat Coal Group" would appear to be the equivalent of the Middle Coal series of England; but we have hitherto looked in vain for representatives of the Lower Coal measures, or Gannister Beds. It thus appears that there has been an increase of sediment in the lower portion, and a decrease in the upper, as compared with the northern districts of England.

"2.—Region South of the Barrier.

"We must now retrace our steps to the district south of the barrier, which includes the coal-fields of South Wales, Forest of Dean, Bristol, and Somerset—Mr. Goodwin-Austen's hypothetical trough of the Thames Valley, and the culm series of Devonshire.

"The sedimentary strata of this region appear to have been derived not from north-west, as in the case of the coal-fields north of the barrier, but from the west-south-west, as indicated by the isometric lines. The variations of development of the Carboniferous rocks have been fully discussed by Sir H. De la Beeche, who shows that the greatest vertical thickness is attained in Glamorganshire of 12,000 feet or more, while east of Bristol the same beds are only 5,500 feet, and in the Forest of Dean 3,385 feet thick.

"To what extent the true Coal measures once surmounted the culm measures of Devonshire it is, of course, impossible to say; but from the position of these beds with reference to the Glamorganshire coal-field, from which they are separated by an antictinal axis, there was probably a large amount of strata now lost by denudation. We must, with Sir R. Murchison, regard the culm measures themselves as the representatives of the Carboniferous Limestone, and probably the Yoredale series and Millstone grit; but, as there are only thin bands of limestone to represent the great limestone formation of Bristol and Chepstow, it is evident the "sedimentary"

elements have predominated in Devonshire, to the disadvantage of the calcareous.

"The Carboniferous series, therefore, to the north and to the south of the barrier belong to two different systems, not of time, but of circumstances. Their materials have been accumulated in nearly opposite directions. The sources of these materials have been different, and also the direction of the currents. That the Carboniferous series was connected by sea, round the western extremity of the barrier, is proved by indentity of fossils in the limestones and Lower Coal-measures of the North of England, Central Ireland, and South Wales, &c. The calcareous member was more fully developed in the east than the west, and extends from Somersetshire into France and Belgium, until, as already stated, it thins away on approaching the Rhine.

"3. North Atlantic Continent.

"Readers of the works of Sir C. Lyell will recollect how that author, in treating of the distribution of the Carboniferous rocks of North America, shows that the sedimentary materials increase in thickness and become coarser in texture as they approach the north-eastern seaboard. Thus in Nova Scotia these materials attain, according to Dr. Dawson, a thickness of 14,000 feet,* in which the limestones play a surbordinate part, as they do in Scotland. From the flanks of the Alleghany range, westward and southward, into Central America, the "sedimentary" strata gradually thin away, while the calcareous as constantly augment in bulk, until, on reaching the Rocky Mountains, they attain magnificent proportions,† forming, as shown by Sir J. Richardson and Dr. Hector, the huge and rugged masses of the central range. The tendency of the calcareous and sedimentary elements of the system to become developed in opposite directions is therefore strongly marked over this Continent.

"From the north-easterly expansion of the sandstones and shales, as well as their increased coarseness in the direction of the North Atlantic, Sir C. Lyell has inferred the existence of a continent (occupying the position of this ocean), from the waste of which these strata have been derived. Mr. Godwin-Austen has also indicated its position. The probability of such a continent is reduced to certainty by the similarity and frequent identity of the Carboniferous flora of Europe and America, the land having formed a bridge for the migration of the plants from one country to another. We may suppose this land to have included Greenland, Iceland, and Scandinavia. Recollecting, then, the south-westerly attenuation of the American strata, and the south-easterly attenuation of the North British, can it be doubted that the same continent was the parent of the coal-bearing strata of both countries? This being admitted, we may also infer that the shores of this *Atlantis* were washed on the west side by a current running south-west, which drifted the sediment in that direction; and on the other by a current running south-east, which carried the sediment over the submerged portions of Scotland, England, and Ireland. It may be assumed as a general principle, that all the oceanic currents north of the equator running west come from the north, and those running east come from the south. Hence we may infer, that, during the Carboniferous Period, there was open sea in the Arctic regions of the Western Hemisphere, generating an Arctic current—a proposition borne out by the occurrence of plants and shells of this period as high as latitude 78°; and, on the other hand, we may infer land to have existed to the north of Europe, or at least of Britain, whose shores were swept by a current similar in its direction to the Gulf-stream. Throughout this long geological period

* "Acadian Geology."

† "Quart. Journ. Geol. Soc.," Vol. vii.

did these currents carry the sands and clays southward; and as the distance from the sources of these materials increased, so did the amount deposited diminish; which to my mind is a satisfactory explanation of the thinning out of strata in certain directions.

"§ III. *Summary of Conclusions.*

"(*General.*)

"1. It appears from the above considerations and examples, which further research will enable us to multiply, that calcareous strata are distinct from argillaceo-arenaceous, not only from differences of origin (a fact now generally admitted), but also in the manner of their distribution; so that limestones ought to be removed from the class of rocks termed 'sedimentary.'

"2. That in any *natural* group or system of strata, consisting, on the one hand, of 'sedimentary' strata, and on the other of calcareous, it appears that the direction of the greatest vertical development of the one will be that of the smallest vertical development of the other. In a word, where the one becomes thin the other becomes thick.

"3. That, on the principles here stated, the frequent occurrence of natural groups of rocks consisting of three members, the first and third 'sedimentary,' the second (central) calcareous, admits of explanation.

"(*Special.*)

"4. That a barrier or tract of dry land existed nearly across central England, dividing the Carboniferous rocks into two distinct regions.

"5. That to the north of this barrier the 'sedimentary' strata of the Carboniferous Period become attenuated from north-west to south, while the *calcareous* strata thin out from south to north, Derbyshire being the centre of greatest development.

"6. That to the south of this barrier the 'sedimentary' strata become attenuated from west to east; while the calcareous thin out from east to west.

"7. That while on the north side of the barrier there was a current bringing the sediment from the north, on the south side there was a current bringing sediment from the west.

"8. That richly productive Coal-measures do not exist under the Eastern Counties."

DESCRIPTION OF WATER-BALANCE MACHINES, USED FOR WINDING COAL, IRONSTONE, &c., IN SOUTH WALES.

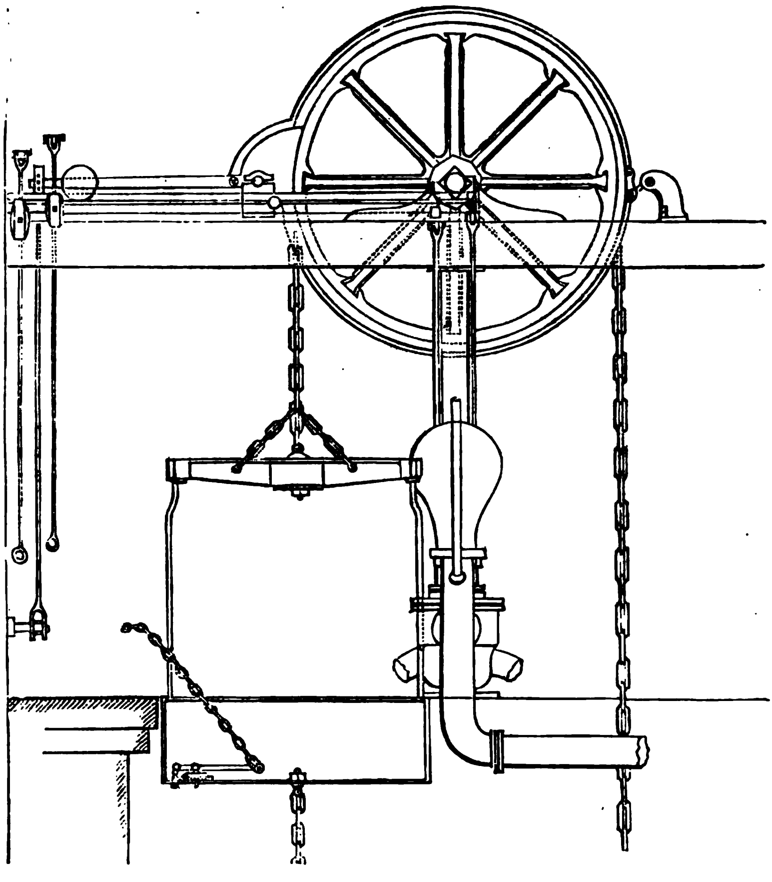
By Thomas Evans, Esq., H.M. Inspector of Mines for South Wales.

(From the Transactions of the Manchester Geological Society.)

Along the northern edge of the South Wales coal-field, the outcrop of the coals are, for the most part, exposed to view, and have been worked for many years in conjunction with the argillaceous ironstone, in a similar manner to slate, stone, or other quarries. There is, however, a limit to this mode of excavating, or as it is locally termed "patching" the mines; it can only be done profitably to the extent that will pay for the removal of the top or superincumbent deposit, and the free water drainage.

When shafts had to be sunk it became necessary to devise some means of lifting the materials, the abundant and continuous supply of water running down the hill-sides to the valleys, suggested the employment of "Water-balance Machines;" they have been, and still are extensively used throughout South Wales to considerable depths, and indeed until of late

Fig. 1.



years a steam-engine for winding coal from shafts was unknown. These water-balance machines are so placed at different levels that the same water, after being used at the one, flows away by its own gravitation to the next, and so on in many cases to five or six consecutively, and then to the adit level at the lowest free drainage; and in some cases they are used even below the adit level, the pumping-engine, or water-wheel, necessary for the drainage of the mine, is made of sufficient power to pump the water back to the adit or surface as the case may be.

The drawing shown in the accompanying cut (Fig. 1) is that of a water-balance machine, at the Cwm Bargoed Pit of the Dowlais Iron Company.

This is an upcast shaft about 154 yards deep, sunk to the "Upper Four-foot Mine;" so well known in the market as the "Merthyr Steam Coal," working about 300 tons of coal a day (twelve hours).

The train containing about 20 cwt. of coal, is placed upon the top of an empty water bucket, at the shaft bottom; and the empty train on the bucket at the top; this bucket upon being filled with water descends,

raising the full train of coal and the empty bucket from the bottom. A valve is placed at the bottom of each bucket, and immediately on its arrival at the shaft bottom, the valve is lifted and the water let off. The next full train is then placed on the bucket and treated in the same way.

The buckets are of a circular form, and are made of half-inch boiler-plate iron, and hold about 2 tons of water.

The over or landing chain is three-linked three-quarter inch iron, weighing about 48 lbs. per yard; the links are fastened together with wooden blocks; it works over a turned pulley, about 9 feet diameter. A single-linked chain, of the same weight per yard as the landing chain, is attached to the bottom of each bucket for the purpose of balancing the landing chain—this chain hangs loose in the shaft.

The motion of the machine is controlled by a powerful break pressing against the pulley.

The guide chains are long-linked, of three-quarter inch iron.

The shaft must necessarily be large to give room for both buckets, it is 18 feet × 10 feet. The weight of the empty train is 10 cwt., and holds about 1 ton of coal; it takes 1 minute 20 seconds to fill the bucket with water and raise the load.

For some time a three-linked chain was used as a balance-weight; it was found, however, in working fast, to raise from the sump a large quantity of water, so much so, as to interfere with the men at the bottom of the shaft, and its use was discontinued. Three-linked chains are unquestionably safer than single linked, and they should not be condemned, for it is a very easy matter to arrange the sump so that the water might run off as quickly as discharged from the bucket.

The water is pumped from the bottom of the shaft to the surface by means of a Cornish pumping engine; the same is also used for the drainage of the mine. The actual cost is as follows:—

	£	s.	d.
One Breaksman, at 18s. per week	0	18	0
Two Landers, at 13s. each per week	1	6	0
Two Hitchers, at 15s. each per week	1	10	0
Oil for pulley	0	1	0
	3	15	0

Making 1,800 tons per week. Cost, $\frac{5}{10}d.$

Add to this half the expense of the pumping engine $\frac{4}{10}d.$ making nearly 1*d.* per ton.

At the Dinas Colliery, the water from the mine, together with that used for working the balance machine, is pumped to the surface by a water-wheel. The shaft is about 90 yards deep, of an oval shape 15 feet × 11 feet. The chain is four-linked, of $1\frac{1}{8}$ inch iron. The balance chain is $1\frac{1}{8}$ inch iron. Each chain weighing nearly 2 tons.

The bucket is of half-inch boiler-plate iron, and measures 5 feet 8 inches × 4 feet 5 inches × 3 feet, raising about 340 tons in twelve hours. The load of coal averaging 22 cwt. One man and a boy are employed at the bank, and the same at the bottom; the man at the bank has charge of the break, as is also the banksman.

At one of the most extensive works in Wales, all the coal and ironstone are brought to the surface by these machines (nearly 1,000 tons per day), and one of the shafts is about 190 yards deep.

The cost of erection in the first place is small, and if attention is paid to the quality and manufacture of the iron in the chains, the repairs are very trifling, with the exception of a little oil for the bearing of the pulleys. They require no stores.

For mines not exceeding 180 yards deep with free drainage, and when

the amount of work required to be done is not more than 250 tons a-day, (for twelve hours,) they are a cheap means of winding coals. The time occupied in filling the bucket with water is the limit to the amount of work that can be accomplished. At greater depths, the machinery becomes so ponderous and heavy as to be attended with inconvenience and danger.

There are in Glamorganshire alone about sixty of these water-balance machines now at work. They are all alike in principle, varying in strength according as the work required to be done, and adapted to the peculiar circumstances which present themselves. The drawings and description of the Dowlais and Dinas Machines, are, I hope, sufficiently clear to be understood; and if the subject induces useful description the object of this paper will be attained.

DISCUSSION.—On the motion of Mr. Binney, seconded by Mr. Atkinson, the thanks of the Society were voted to Mr. Evans for his paper.

Mr. A. Knowles.—I have heard there are no water-balance pits in Lancashire.

The President (Joseph Dickinson, Esq., F.G.S.).—I think I have seen some at the Hæmatite Mines, at Dalton and Lyndal, in North Lancashire; and also at Cleator, in Cumberland. Then again, there is one at the Blue Ball Colliery, at Bacup, but it is worked somewhat differently; it is worked by a rope which goes over a drum, in the ordinary mode of winding with the steam-engine; both ropes go over the drum. Then there is another at Cliviger Colliery, in this county; but they are not numerous, except in South Wales. There were some at Worsley; and it is only a few years since they ceased work there.

Mr. Binney.—I have not been there for many years. They were Brindley's.

The President said in South Wales it was found more economical to employ the surplus water than to employ a winding engine.

Mr. Hull said that the power of gravitation was more used in South Wales than in any other coal-fields in Great Britain, owing to the mountainous character of the district.

The President.—The reference which Mr. Evans gives for pumping the water of the balance pits is only ¾*d.* per ton; which is a small sum, that is for the depths to which they have already gone.

AN IMPROVED SAFETY-CAGE FOR MINERS.

AT the meeting of the Manchester Geological Society on Tuesday, April 29th, Joseph Dickinson, Esq., F.G.S., in the chair, Mr. T. Farrimond, of Manchester, read the following paper (illustrated by photography) on "An Improved Safety-cage for Miners":—

Wire ropes have now come into general use, especially in shafts of more than ordinary depth (say 300 yards), being recommended principally for their lightness as compared with the hempen ropes, the latter being nearly double the weight of the former for the same strength. The rigidity of wire ropes is such that there is great strain laid upon them, and also upon the machinery, in overcoming the inertia of the load in starting from the shaft bottom; and should any of the wires be unequally stretched they are almost certain to rupture; for it is a fact, that wire ropes invariably break soon after starting with the load, which is owing entirely to the want of elasticity in the wire; nor are these broken wires easy of detection; the ropes indeed, require to be examined with the greatest care and minuteness, owing, in a great measure, to the ingredients used to protect them from oxidation and to reduce friction. To remedy this evil, box-springs are applied to the end of the rope, but those that have been

hitherto in use, are so defective that they retain their elasticity for a very short time. No doubt the box-spring is superseded by those used in connection with the various patent safety-cages, which are now becoming so extensively used, and which must of necessity be kept in working order, and replaced so often as they lose their power to return to the place they were originally fixed, otherwise the safety apparatus is rendered futile; but, even these springs are far from what could be desired, and there is not the least doubt that if a perfect spring was applied, one-half the proof strength of wire ropes could be worked with as much safety as one-third.

The most effective spring I am aware of, is one that I have had at work some time at the Bardsley Colliery, in connection with a safety-cage apparatus which I shall shortly have occasion to mention; this spring may be termed a coach spring, which can be applied with facility to any part of the cage, so that one extremity of the spring or its centre is immediately under the rope, or middle of the cage, which is connected by a chain from the rope, which is shorter than those that are attached to the cage; consequently the centre or short chain lays hold of the spring in the first instance, and brings it to the required position before the drawing chains can take hold of the cage and its load; this spring can be made of any strength (which of course must be regulated by the weight of the cage), and it will travel a greater distance, and retain its elasticity longer than any other kind of spring, therefore, it is with confidence recommended to all collieries where wire ropes are used.

With regard to safety-cages, the necessity of which is becoming more acknowledged, and their adoption more general throughout the coal-fields of Great Britain, their efficiency depends almost entirely upon the springs by which they are worked; and as these springs are more or less perfect, so we may conclude will be the safety apparatus itself. If the springs have lost their strength, and cannot compel the rope to travel with greater momentum than the cage, the catches are kept open and the cage falls to the bottom of the shaft. The velocity of the rope, though there is no friction, is greatly impeded by its being brought in contact with the pulley frames, head stocks, horse trees, and conducting rods of the shaft, from which it is evident that if the springs are not sufficiently powerful to pull the rope to the cage, or if one of the springs should be stronger than the the others, and bring one of the levers against the conducting-rod before the others, it is almost certain that the rods are broken, and the cage leaves them entirely.

In my improved safety-cage (which I have before alluded to) all the levers must work at once; one cannot move unless they all move, as they are all in connection with one spring, the most perfect yet made. The levers are eccentric, and when in work hang perpendicularly, and four or five inches from the rod, but when brought into action, they travel through an angle of 90°, and strike the conducting rods in a tangent, and bring by degrees a large diameter to bear upon the rods; if they are of wood they embed themselves, if of iron or wire they act as a break, with a certainty that will be at once apparent to any one who sees them. The spring can be very easily tested by the banksman letting the chains hang loose, and then lifting the centre chain, and, consequently, the spring. The cage can be arrested, when descending the shaft, by the chain being held by a person standing on the top of it, and when the cage is traveling at the ordinary speed, by letting the chain go, the cage is instantly stopped.

The total weight of the cage—(drawing 24 cwt. of coal each time) from which three photographic views have been taken, and are now before you—does not exceed 8 cwt., which includes the safety catches. The weight of the safety apparatus is half-a-hundred weight, being less that half the weight of any other safety apparatus. This fact is not to be overlooked, nor the adaptability of the apparatus to any kind of drawing tackle for

winding minerals to the surface, whether carriages or carriers, and whether the conductors be wire or iron, which are mostly used in our deep up-cast shafts. The simplicity of the apparatus, too, is such that any blacksmith can make it and put it on to any cage or carrier in one day.

In the course of the discussion which followed the reading of the paper, Mr. Lacey said the cage described by Mr. Farrimond seemed very like one which had been invented for the Belgian mines by a Frenchman, and of which he had a drawing.—Mr. Farrimond (after looking at the drawing) said the spring was something like it, but that was all. The President called attention to a recent paper on a similar subject by Mr. Landale, in which it was sought to be shown that the springs were a novelty. Mr. Binney pointed out that the President answered the matter then, that it might be for Scotland, but would not be for England. In reply to Mr. A. Knowles, Mr. Farrimond said he had only one spring to his cage, and that the spring of this and the springs of the other safety-cages in use, took off the jerk and saved the winding ropes.

At a subsequent meeting of the society on May 27th, Mr. Farrimond, being called upon by the President, explained a model of his cage, which was then before the society.

He said, the weight of the cage is supported by four chains, but before these chains come to bear weight, the centre chain is stretched, and pulls the springs into a position to bring these levers perpendicular. The levers are attached to the two shafts; and as soon as the rope breaks, of course the centre chain goes slack, and the levers come to and strike the rod at an angle of 90 degrees, and being eccentric the more weight that is brought to bear on them the tighter they hold.

In reply to questions, Mr. Farrimond said, that to have teeth in the conducting rods would not be very convenient; and that his invention would act equally well with iron as with wooden conducting rods.

The President (Mr. Dickinson).—In White and Grant's apparatus I think it was found, that the length of those bars are so great, that when any strain comes upon them, they bend. The apparatus we have working in this country, has the working apparatus close to the bearing surface, which is a great advantage; but in this instance you have it removed as far as possible from the bearing surface.

Mr. Farrimond.—In White and Grant's cage, the springs were at the end of the rods, and the power was applied in the middle, which twisted them. In mine, the power is applied direct to the spring or bearing surface, and not to the rods, as the President supposes.

The President.—Supposing these bars get bent?

Mr. Farrimond.—They cannot get bent—they have nothing to do but simply turn their own weight. The office of the spring is to pull the rope to the cage, so as to allow the rods to turn round, each on its own axis.

The President.—Still all the action is given to these rods from the centre.

Mr. Farrimond.—But there is never any strain put on them.

Mr. Hull asked if accidents from the breaking of the rope were not very rare?

Mr. Binney replied that many lives were lost in that way every year.

The President said it was a common rule, that the weight of men in one cage should not much exceed half the dead weight.

Mr. J. Atkinson said, accidents through the rope breaking generally happened in a morning, and he supposed the rule which compelled the letting down the cage and bringing it up again before the men were sent down was not often attended to.

The President said he thought, on the contrary, that that rule was strictly obeyed; and Mr. A. Knowles concurred.

Mr. Binney.—It is difficult to speak about ropes. I once saw two heavy

women brought up a shaft, and when the empty cages were sent down immediately after, the rope broke.

The President.—When there is much swing allowed to the rope between the engine and the pulley, it is surprising what a strain there is put upon it.

Mr. Binney.—It is desirable that there should be every care and caution used in letting men down and bringing them up the pit. There cannot be too many contrivances to save life.

Mr. J. Atkinson said Mr. Farrimond's cage seemed well adapted for the purpose for which it was intended.

The President.—I can only see the objection I have named.

Mr. Farrimond.—And that is no objection in reality.

Mr. Birkenhead said he thought the most important part of a safety-cage was its springs; and if he was not mistaken, many of the largest coal proprietors objected to safety-cages altogether, because they thought that, in the hour of need, they would be found wanting. It should be remembered, that whilst the safety-cages were in operation and going on well, the springs were generally in a state of tension, and the constant vibration made them rapidly lose their power and elasticity. The springs should therefore be constantly examined.

Mr. J. Atkinson said he thought it might be possible to make the cage so that the springs should only come into use when the rope broke.

Mr. Farrimond.—It all depends upon the spring. This cage has the best spring that has yet been invented. That is the great principle of this cage.

Mr. Birkenhead.—The same objection applies to all springs.

The President.—The banksman at the top ought to see that the springs are in working order. It may be seen every time the cage rests upon the catches.

Mr. Binney said there was nothing in a mine which required looking after so much as, what were termed, the simplest apparatus.

MINERS' PERMANENT RELIEF FUND.

An important meeting was held at the Town Hall, Durham, on the 31st May, for the purpose of promoting a local Permanent Relief Fund for the two counties of Northumberland and Durham. The chair was occupied by the Rev. G. T. Fox, Vicar of St. Nicholas, Durham, and the meeting seems to have been well attended by the pit-men of the district. The first resolution was moved by Mr. James Liddell, a miner, and seconded by Mr. Bramwell, the Recorder of Durham: it pledged the meeting to an approval of the project of establishing a Permanent Relief Fund for Northumberland and Durham. The principal statement made at the meeting was by Mr. W. P. Shield, a working collier, who entered into an elaborate series of statistical details, in order to show the amount of subscription which would be required from the working man to make an adequate allowance to themselves or their widows and children in case of permanent disablement or fatal accidents. He commenced by stating that they all knew how much the movement had been delayed and crippled by the wish to secure the co-operation of the coal owners; but that co-operation not being forthcoming, the men had determined to go on by themselves, and they had communicated with several influential gentlemen in Newcastle and Durham; and the consequence was that the gentlemen now on the platform, with others whose engagements would not allow of their being present, had generously come forward to aid them in establishing a Miners' Permanent Relief Fund.

Mr. Shield's statistics showed that in the three counties of Durham,

Northumberland, and Cumberland, the deaths from colliery accidents during the ten years ending 1860, amounted to 1,597, which gave an average of 159·7 a-year out of about 51,000 persons, the average number employed during that period. This gives a death-rate from accidents of 3·13 per thousand. Another table showed that the number of persons employed under and over ground in the coal trade of the three counties in 1861, amounted to 60,000;—44,600 men, boys, overmen, and deputies, employed underground; and 15,400 men and boys employed overground. Of this, 60,000, 44,443 were above 18 years of age; and 15,557 under that age.

If the 44,443 men above 18 were to pay a contribution of 1*d.* per man per week, a sum of 9,629*l.* 6*s.* 4*d.* a-year would be realized; and a payment of ½*d.* per week by those under 18 would give 1,685*l.* 6*s.* 10*d.* yearly—making a total of 11,314*l.* 13*s.* 2*d.* Taking the death-rate of 3·13 per 1,000, it would give us a total of 188 deaths per year from the 60,000 persons employed. Of this 188, it would be found that ⅜ths of the whole, or 75, are married men, leaving a widow, and on an average, 3 children each; of the remainder, about another ⅜ths, or 45, are single men having no immediate dependents, and ⅜ths, or 68, are boys under 18 years of age.

Now, an annuity of 5*s.* per week to each widow for 5 years would cost 56*l.* 5*s.* 8*d.*, or 4,221*l.* 5*s.* for the 75. An annuity of 2*s.* per week for 4 years to each child would cost 18*l.* 8*s.* 4½*d.*, or 4,143*l.* 18*s.* 1½*d.* for the 225. An allowance of 25*l.* to the relatives of each of the 45 single men would be 1,125*l.*, an allowance of 15*l.* to the relatives of each of 68 boys would be 1,020*l.*—making a total of 10,510*l.* 3*s.* 1½*d.*, thus leaving a balance in hand of 804*l.* 10*s.* 0½*d.*

With regard to the number of accidents resulting in permanent disablement, the data is much less certain. Mr. Shield is of opinion that the number of men who would be entitled to claim, as permanently disabled,—that is incapacitated for work for more than 6 months, would be small. Supposing, however, that one out of every 1,000 injured, were rendered incapable of working any more, it would require 1,870*l.* to secure each 5*s.* per week for life, supposing their average age to be 35. Mr. Shield considers that the balance of 804*l.*, together with the interest, subscriptions of honorary members, donations, &c., would be amply sufficient to provide for these and other cases. Mr. Shield went on to say, that this was all a penny a-week would do. There was no use disguising it, and those persons who pretended it would do more, were not to be depended upon, because they were either ignorantly or designedly trying to lead the miners astray. If they wished for greater benefits, they must pay a higher rate of contribution; but there was no limit to the benefits they might receive, if they were willing and able to pay for them. Another subject to which the committee turned their attention was, to get rules for the government of the society; and after due deliberation, they had drawn up a set, which would be subject to any alteration or amendments which the majority might deem desirable. Mr. Shield then read the draft rules, whose principal provisions are as follows:—

The society shall be called "The Northumberland and Durham Miners' Permanent Relief Fund." Its benefits may not be exclusively confined to these two counties, but shall be open to the co-operation of miners, when organized, in other districts of Britain. It has for its objects, the raising of funds to provide, in cases of fatal accidents, for the widows and children or other dependent relatives: and where the workman is permanently disabled, to make suitable provision. When a member has been laid off work from accident for a period of six months, he shall be entitled to relief as a permanently disabled member. The members shall consist of all persons employed in or about collieries. All other parties may assist by becoming donors to the amount of 10*l.*, or annual subscribers of 1*l.*, such parties to be honorary members. That each colliery or branch have a

committee, president, secretary, and treasurer. Districts to be formed by collieries (not more than twelve) uniting. Any member removing to any colliery, either in or out of these counties, may remain a member by sending his money. District delegate meetings shall be held quarterly, each colliery in the district to send delegates. Districts or collieries to have the power of making by-laws to regulate their meetings, and other business in accordance with the general laws. That each member pay 1*d.* per week, and if any member neglect to pay his contributions for six weeks, he shall be fined 2*d.*, and if behind three months, he shall be excluded from all benefit of the society, until he pay up all arrears, and a fine of one shilling. In the case of a fatal accident, the dependent relatives shall receive as follows:—Widow, 5*s.* per week; each child, unfit for work, 2*s.* per week. Young men, above 18 years of age, full-paying members, to nominate a person, who shall receive, at the member's accidental death, the sum of 25*l.*; boys under 18, their relatives to receive 1*l.* The local committee, for the time being, to act as guardians to children left orphans through accidents. In cases of permanent disablement, full members to receive 8*s.* per week; half members, 4*s.* After several other rules relating to administrative details, the committee concluded by recommending that each colliery, where considered necessary, should form a separate fund for minor accidents, and other matters which may appear to require relief.

In the course of the discussion which ensued at this meeting, frequent references were made to the "National Association," and their representative, Mr. Towers. We have already expressed our opinion that this gentleman showed a considerable want of discretion in his agitation in the northern coal district; and this opinion seemed to be shared by the meeting. We are quite satisfied that after the first excitement is over, local feelings and influences are certain to prevail, and that the notion of delegating the management of their affairs to an association in London will be repudiated on all sides.

The principle of self-dependence, upon which the movement is founded, cannot be too highly appreciated. We fear, however, that the calculations are a little too sanguine, and that the solvency of such a fund would not be secure under all contingencies without extraneous help. But we are satisfied that this help will not be wanting, and that, consequently, we may hope to see the present scheme established by the co-operation of all classes on a sound basis, as a model for the imitation of the other mining districts of the kingdom.

Other meetings have been held since, and we are happy to say that the Local Fund movement may now be considered as an established fact. At a meeting of the delegates held last week, Mr. John Howie in the chair, it seemed probable that the movement would receive the support and countenance of Lord Durham, the Bishop of Durham, Lord Hastings, Mr. John Straker, Mr. Fox of Durham, Mr. Hugh Taylor of Backworth, and other noblemen and gentlemen of position and influence in the counties of Northumberland and Durham. At the meeting it was also resolved that the rules should be submitted to a respectable solicitor in Newcastle, and then sent to Mr. Tidd Pratt to receive official revision.

The movement got up in connection with the "National Association" seems on the eve of collapsing. We last month expressed our surprise at the proceedings of Mr. Towers being approved of by some, at least, of the gentlemen on the council of this ambitious "Association," and at such men as Mr. Samuel Gurney consenting to receive workmen's moneys under so crude a scheme. It now appears that Mr. Towers' proceedings have not met the approval of the council; and Mr. Gurney writes that it is impossible to proceed further until the accounts are investigated. The following

letter has been addressed by Mr. Towers to the local secretary; the tone of the letter speaks for itself:—

"10, Duke-street, St. James's, London,
"June 12, 1862.

"My dear Scott,—I have been most disgracefully treated. Notwithstanding all my exertions, my complete success in the North and in Yorkshire, you will be more than surprised when I tell you, that on my return to London I was received by some of the council—all of whom I appointed—with an amount of insulting coldness that no gentleman could bear. It is quite evident our enemies have been active, and have succeeded in poisoning the minds of the more timid. It has been insinuated that I endeavoured to promote ill-feeling between employer and employed,—that I had brought the association into disrepute. These foul aspersions I indignantly repelled, and yesterday I sent in my resignation. Whether the present council will attempt to carry on, I know not; but you know what I have done for the miner, and on your verdict I am content to rely. If you continue confidence in me, I will stand by you, and form a council consisting of some of the most distinguished nobles of the land. Pray see or call a meeting of all our friends, explain the real position of affairs, and be assured, if you are only firm, I will carry our object triumphantly. Let me hear from you fully, to my new address, as early as possible. In a few days you shall have the names of the council.—Yours very sincerely,

J. Towers."

Notes and Queries.

Manchester Geological Society.—At the meeting of this society, on Tuesday, April 29th, Joseph Dickinson, Esq., F.G.S., President, in the chair. The President stated than an excursion would be made on the 7th May to examine rocks in the neighbourhood of Dulesgate and Gauxholme, where some fine sections of lower coal-measures might be seen. A conversation took place on Safety-Lamps, on a model exhibited by Mr. J. Scott Withnall of Manchester; there was nothing novel in this lamp, except the mode of fixing the lock to the solid bottom of the lamp.—The following papers were then read:—

1. "On the Geology of the Railway between Hyde and Marple." By Mr. John Taylor, jun.
2. "The North Staffordshire Coal-Field," By Mr. John Bradbury, jun.
3. "On an Improved Safety-cage for Miners." By Mr. T. Farrimond. This we have abstracted elsewhere.

At the meeting of Tuesday, May 27th, Joseph Dickinson, Esq., F.G.S., President, in the chair, Mr. Binney read a short account of the Society's recent excursion to Todmorden.—Subsequently a further discussion took place upon Safety-Lamps.—The following paper was read:—

1. "Description of Water-Balance Machines used for winding Coal, Ironstone, &c., in South Wales." By Thomas Evans, Esq. Discussions also took place. "On the Model of a New Safety-cage for Miners;" and "On a specimen of Sternbergia, and a rounded piece of white quartz found in a bed of coal." By Mr. Farrimond.

Geological Society of London.—At the meeting of this society, on Wednesday, June 4th, Professor A. C. Ramsay, Esq., in the chair. The Rev. David Honeyman, Antigonish, Nova Scotia, Geologist to the Commission for that Colony in the International Exhibition, and Alexander Macdonald, Esq., Aberdeen, were elected Fellows.

The following communications were read :—

1. "On the disputed affinities of the Purbeck Mammalian genus *Plaigaulax*." By Hugh Falconer, M.D., F.R.S., F.G.S.

2. "On some Fossil Plants from the Hempstead Beds, Isle of Wight." By the Rev. Dr. O. Heer, Professor of Botany, Zurich. With an introduction, by W. Pengelly, Esq., F.G.S.

3. "On Glacial Surface-markings on the Sandstone near Liverpool." By G. H. Morton, Esq., F.G.S.

The author here noticed the occurrence of glacial grooves and scratches at—1st, Toxteth Park, the direction of the striæ being N. 42° W., at 120 feet above the sea; 2nd and 3rd, at Boundary lane and New-road, Kirkdale, the striæ being N. 15° W., and at about 80 feet above the sea.

At the meeting on Wednesday, June 18, Professor A. C. Ramsay, President, in the chair, John Cumming, Esq., 7, Montagu-place, Russell-square, and William Topley, Esq., of the Geological Survey of Great Britain, Colchester-villas, Lewisham-road, were elected Fellows.

The following communications were read :—

1. "On the Mode of Formation of some of the River-valleys in the South of Ireland." By Professor J. B. Jukes, F.R.S., F.G.S., of the Geological Survey of Ireland.

Mr. Jukes's paper contained a description of the physical structure of that part of the South of Ireland south of the limestone plain that extends from Dublin to Galway Bay. He showed that the rivers Shannon, Barrow, Nore, and Suir, after traversing this low ground, escaped to the sea by ravines worn through lofty hills of Old Red Sandstone and Lower Silurian rocks. He also instanced the rivers Blackwater, Lee, and Bandon as each suddenly deserting the low longitudinal valleys through which they had run for many miles, and turning at right angles down ravines of Old Red Sandstone, notwithstanding the fact of the longitudinal valleys being continued with no apparent obstruction to the course of the rivers. He showed the connection of these lateral ravines with the coming of strong brooks from the higher ridges on the north into the longitudinal valleys, and also that these brooks probably produced the ravines, having first began to erode them over a surface above the present ridges, and before the formation of the longitudinal valleys.

He considered the fact proved, that the present "form of the ground" in the South of Ireland was produced by atmospheric erosion on dry land; and that the limestone ground was low because the rock had been dissolved chemically as well as eroded mechanically; and that its surface had sunk to a lower level than the other rocks, like that of a glacier melting in its bed. He proposed to extend this explanation generally to all dry land.

2. "Experimental Researches on the Granites of Ireland.—Part III. On the Granites of Donegal." By the Rev. Professor S. Haughton, M.A., F.R.S., F.G.S.

The author described in detail the geographical position, physical structure, geological relations, and the chemical and mineralogical composition of the granite of Donegal, which consists of four minerals—quartz, orthoclase, oligoclase, and black mica, with perhaps an unknown paste besides. The oligoclase affords evidence of the probable identity of the granite of Donegal with that of Northern Scotland and of Norway. The author also alluded to his success in obtaining a formula for the determination of the proportions of *four* minerals in a compound rock, from the relative specific gravities of the mass and of its constituents.

3. "On a Stalk-eyed Crustacean from the Coal-measures." By Professor T. H. Huxley, F.R.S., Sec.G.S.

4. "On the Premolar Teeth of *Diprotodon*, and on a New Species of that

Genus from Queensland, in Australia." By Professor Huxley, F.R.S., Sec. G.S.

5. "On the Old Red Sandstone of Fifeshire." By James Powrie, Esq., F.G.S.

Having again examined some sections of the Old Red at Whiteness, near Arbroath, and elsewhere, the author is satisfied of a local unconformity of the Upper on the Lower Old Red, but that no other locality in Forfarshire exhibits this want of conformity; and neither in Fifeshire nor Perthshire does the author find a section distinct enough to exhibit such a break in the series.

6. "On some Upper Coal-measures, containing a Bed of Limestone, at Catrine, in Ayrshire." By E. W. Binney, Esq., F.R.S., F.G.S.

Some red and purple strata near Catrine, underlying the Permian breccia of Ballochmoyle, were referred to in 1856 by the author. He has since revisited the locality, and finds that these strata at Ballochmoyle Braes, Catrine, and Sorn represent a coal-field as high as any in the English series; in fact, similar to those at Ardwick near Manchester, Uffington, Leebotwood near Shrewsbury, Buxtaby near Nuneaton, and Lane End Potteries. Mr. Binney referred to the observations made by Mr. Ralph Moore, and by Geikie and Murchison, and pointed out how far he differs from them. Mr. Moore gives 565 fathoms for the whole series in Ayrshire; the author finds reason to add nearly 300 fathoms of Carboniferous strata (not productive of coal) to the above estimate.

7. "On the Geological Structure of the Southern Grampians." By Professor James Nicol, F.R.S.E., F.G.S.

The author stated that, in 1844, and in subsequent years, he indicated that the Silurian strata of the South of Scotland are represented in the North by the metamorphosed or so-called primary strata; and he proceeded to point out that the object of the present communication is to examine the relation which the three great formations, Clay-slate, Mica-slate, and Gneiss bear one to the other as regular constituents of the crust of the earth, and especially in certain parts of the Scottish Highlands, as illustrated by sections observed by himself. These he correlated with what is seen in other parts of the Highlands.

Contrasting his published sections with the corresponding ones given by Sir R. I. Murchison and Mr. Geikie, he observes that, though represented as maintaining the identity of the gneiss of the west coast with certain mica or chlorite-slates, yet he has, in former papers, and in his published map, always regarded them as being identical only so far as both belong to the great series of metamorphic formations inferior to the red sandstone and quartzite, but still as distinct formations with peculiar features, and, it may be, of widely different age.

8. "On some Natural Casts of Foot-prints from the Wealden of the Isle of Wight, and of Swanage." By S. H. Beckles, Esq., F.R.S., F.G.S.

9. "Geological Notices on Zanzibar." By Richard Thornton, Esq. In a letter to Sir R. I. Murchison, F.R.S., F.G.S.

From the coast to the coast-range (600 to 1,300 feet high), the country consists of a series of strata with an easterly dip, namely (from above downwards) coral-limestone, sandstone, yellow shale, and sandstone with plant-remains. The mountain Kilimanjaro is formed chiefly of volcanic rocks. White and altered sandstones, with easterly dip, are met with also in the Massai Plain.

10. "On a section at Junction-road, Leith." By W. Carruthers, Esq., F.L.S. Communicated by S. P. Woodward, Esq., F.G.S.

The author stated that in the section of clay, sand, and gravel, near Leith, described by Mr. Geikie as part of a raised beach elevated since the period of the Roman occupation, not only have mediaeval pottery and

tobacco-pipes been found in the pottery-bearing deposits described by Mr. Geikie, but a mediæval jar has been met with in the sand beneath. The so-called "Roman" pottery was stated by the author to be of mediæval age, on the independent authority of Messrs. Birch and Franks, of the British Museum; and he believes that the beds in question are mainly of late and artificial formation; he does not, however, argue from this that there is no evidence of a late upheaval of the central part of Scotland. [Specimens were exhibited in illustration of this paper.]

11. "On the Death of Fishes in the Sea during the Monsoon." By Sir William Denison, Governor of Madras, &c. In a letter to Sir Roderick Murchison, F.R.S., F.G.S.

Steaming between Mangalore and Cananore on the west coast of India, the author found that for some time after the south-west monsoon the sea was offensive with dead fish, killed by the great mass of fresh water poured into the sea during the season of the monsoon.

The next evening meeting of the society will be held on November 5th.

THE NEW COAL MINES' BILL.—The following is the principal clause in the new act, brought in by Sir George Grey, for providing against such accidents as that of the Hartley Colliery :—

"After the passing of this Act, it shall not be lawful for the owner of a new mine, and after the first day of January, 1865, it shall not be lawful for the owner of an existing mine, to employ any person in working within such mine, or to permit any person to be in such mine for the purpose of working therein, unless there are in communication with every seam of such mine for the time being at work, at least two shafts or outlet, separated by natural strata of not less than ten feet in breadth, and affording distinct means of ingress and egress to the persons employed in the mine; but it shall not be necessary for the two shafts or outlets to belong to the same mine, if the persons therein employed have a free right of ingress and egress by not less than two shafts or outlets, one or more of which may belong to another mine. This section shall not apply to opening a new mine for the purpose of searching for minerals, or to any working for the purpose of making a communication between two or more shafts, so long as not more than twenty persons are employed at any one time in the said new mine or working." Provision is made for exceptional cases, in which mine-owners are to be allowed an extension of time in sinking the second shaft of new mines.

THE COLLIERY GUARDIAN.—The 3rd volume of the "Colliery Guardian," from January to June, 1862, has just been completed.

MINING ASSOCIATION OF GREAT BRITAIN.—A general meeting of the Mining Association of Great Britain was held at the Craven Hotel, on Friday, the 27th instant, for the purpose of taking into consideration, the provisions of the Bill introduced by Her Majesty's Government, for amending the law relating to the working of coal mines. In the absence of the President of the Association, Mr. Nicholas Wood, the chair was taken by the Treasurer, Mr. Woodhouse, who briefly explained the objects of the meeting, and read a letter of apology from Mr. Wood, in which that gentleman expressed his regret that owing to temporary indisposition, he could not be present, and his earnest desire that the meeting would give its assent to the Government measure. The Chairman then, according to custom, read the financial statement, from which it appeared that the assets of the Association, including arrears of subscriptions, amounted in round numbers to 1,000*l*., and the debts of the Association to 250*l*., which would leave a balance in its favour of 750*l*. He then requested Mr. Parkes, the Parliamentary agent, to read the clauses of the Bill, and state his opinion as to how he thought they would work. Mr. Parkes having read the clauses of the Bill, and given his views as to their general scope and

effect, a discussion took place, in the course of which several members suggested some verbal amendments where they thought the language of the Bill was of doubtful import, and with the view to render the measure more effective, and more satisfactory to all parties concerned. The proposed amendments having been approved by the meeting, the Chairman, and Mr. Day, the Secretary of the Association, were deputed to submit them to the President for his consideration and sanction, and they were also instructed to assure him that the sole object of the amendments, was to simplify and improve the Bill. The meeting was adjourned *pro tem.*, to allow the Chairman and Mr. Day an opportunity of conferring with the President of the Association. On their return, the meeting resumed, and the Chairman having reported that Mr. Wood generally approved of the proposed verbal amendments, it was agreed to submit them to Sir George Grey, with a request that he would adopt them. The meeting was then adjourned to two o'clock on the following Tuesday.

Glasgow School of Mines and the Society of Arts' Examinations. —Out of the thirteen students who this year presented themselves for examination in mining and metallurgy for the Society of Arts' prizes and certificates, ten have been successful. The first prize of 5*l.* has been awarded to Alexander Crawford, from Towerlands Colliery, Dreghorn, near Irvine; he is 25 years of age, and up to the time of entering this institution, about six months ago, he was maintaining his wife and family by hewing coals. About twelve months at a village school is, according to his own testimony, the only time he has been favoured with for school education prior to entering the School of Mines. The second prize of 3*l.* has been awarded to Thomas Muir, of Wellwood Colliery, Dunfermline, Fifeshire; he is 18 years of age, and has had four years' elementary education previous to entering the School of Mines. Certificates have been awarded as follows:—

John Bryden, 26 years of age, from Dalzellolie Colliery, near Ayr; 2nd class.

John Park, 20 years of age, from Old Fanne Colliery, Rutherglen, near Glasgow; 2nd class.

James McKillop, 17 years of age, from Balquhatstone Colliery, Slamanan; 2nd class.

James Radcliffe, 22 years of age, from Old Fanne Colliery, Rutherglen, near Glasgow; 2nd class.

William Barrowman, 16 years of age, from Kinneil Iron Works, Boness; 2nd class.

James Smart, 34 years of age, from Newton Colliery, near Glasgow; 2nd class.

James Millar, 25 years of age, from Mr. Russell's Collieries, Wishaw; 3rd class.

Robert Burns, 27 years of age, coal agent, Glasgow; 3rd class.

The Glasgow School of Mines has not yet completed the third year of its existence, and notwithstanding the shortness of this period, the students from it are now many of them in important situations in connection with colliery mining, and are, moreover, not confined to Scotland, but are at present to be found as colliery managers in all the three kingdoms. Besides these, two have gone to push their fortunes in Queensland, and one in New Zealand.

Mining, Quarrying, and Metallurgical Review.

CORNWALL AND DEVON.

During the past month, Cornish mining has shown considerable activity —particularly when we consider the heavy and continuous fall in the standard of copper ores, and the comparatively low price of tin. Certain mines, indeed, have enjoyed an amount of favour with the public —judging at least by the price of shares—which have astonished those who look at mining from a cool practical point of view, rather than its speculative and excited aspect.

In the extreme western part of the county, the districts of St. Just and St. Ives present no features particularly new. With the present price of tin, many of the mines can be expected to do little more than pay cost; but with higher prices we all hope for, the old tin region of the peninsula of Penwith has a fine future before it.

About the Marazion district nothing very important has occurred during the month, except the change in the management of Charlotte United from a London Office to the hands of Mr. John Hosking. The engine which was most unadvisably erected on the old Trenow Mine, to the west of Wheal Charlotte, on the supposition that it would aid in easing the water from the latter, is now to be removed to replace the present engine, with the consent of the lord—Mr. Trevelyan—who has acted liberally and handsomely in the matter.

The most extensive concern in the Marazion district, the Prosper United Mines are opening out well—indeed almost better than could have been expected. The heavy surface outlay is now made, and it only remains to develop the mine underground on an equal scale, when there is no doubt that Prosper United will make a permanently large-producing mine, and it is to be hoped a fairly profitable one also.

The proposed re-working of an old mine—Wheal Neptune—is announced by a "limited" company, with a capital of 15,000*l*. The old mine is a moderately fair speculation, but the proposed capital is evidently inadequate, particularly as large premiums are to be paid for the setts—among others, 500*l*. to Mr. Absalom Bennett. As the promoters of this proposed company rely entirely on the general public for raising their capital, it is not by any means certain that they will be successful in obtaining it. Another "limited" company was started two or three years ago in the same district, called the "St. Aubyn Mineral Company," but the promoters were unsuccessful in raising their capital, and the "company" is now in the process of being "wound-up."

In the neighbourhood of Hayle, the only matter worthy of notice is the final arrangement between the Alfred Consols and the Great Alfred Adventurers, for the purchase, by the former, of the Great Alfred sett. That the eastern part of Great Alfred is worthy of a trial is undoubted—indeed it should have been made long ago—but whether it will be possible to carry out the trial effectually now is not so clear. A considerable amount of capital will be required.

The tin districts of Breage and Wendron are suffering more or less from the depression of the tin standard. In the Breage district, Great Fortune continues to open out well on the Carnmeal lode, which at present shows every prospect of making a large mine. Sithney Carnmeal, working on the same lode in Sithney parish, has also sprung into some favour which it is well worthy of, for it seems a very eligible speculation. Wheal Metal (worked as Great Wheal Vor) is also looking well, although no dividend was declared at the last meeting: judging from the value of the tin

ground met with, it would seem that this mine was not making as much profits as might be expected.

In the Wendron district the mines are rubbing on much as usual. In Trumpet Consols, one of the most important mines in the district, Mr. Henry Rogers, of Helston, has been appointed Purser. West Wendron Mine, adjoining Wendron Consols, which has been at work for a couple of years under the management of Captain Kendall, of Charlotte United, has recently been sold off, the materials being purchased by a local party, who intend prosecuting the mine with vigour. The recent management of this mine has been quite as bad as that of Charlotte United. Basset and Gryll's mine, Garlidna, and others in this district, are pursuing their course with varied success.

In the Gwinear district there is nothing particularly new. The mines are generally poor, if we except a nice little discovery made in Rosewarne Consols which promises good results.

In the Camborne and Illogan districts, mining on the whole has been decidedly active. The rich mines pursue their course steadily, affected only by the fall in price of tin and copper. How the fall in the price of tin affects such a mine as Dolcoath, returning 164 tons of tin in two months, will be judged when we state that this now brings 15*l.* per ton less than it would have realized two years ago, which makes a difference of 15,000*l.* a-year. There is no stronger evidence of the almost boundless resources of this great old mine than the manner in which, in the face of this fall, it keeps up its returns and profits.

The Setons generally are looking up. Wheal Seton has much improved of late; and in South Seton also, at the other end of the run, an improvement has been met with. New Seton, which is one of the favourite concerns of the day, is in tremendous demand, and sells at great prices, but no discovery has yet been made. At West Tolgus the water has been in for some time in Wheal Raven shaft, and the sinking of the engine shaft has been suspended for the putting in of new roads. The engine-shaft is now again in course of sinking in a good lode.

In the Redruth district, there has been a great deal of speculation of late, particularly in East Carn Brea, Wheal Uny, and Wheal Union. East Carn Brea is a very pretty little mine, and a very fine piece of ore ground has been opened out on the south lode; but as to the price of shares, that is another affair. It has been decided to erect a new 70-inch engine here, on the new shaft going down on the south lode, which will place the mine in a first-rate position. Uny, which adjoins East Carn Brea on the west, is also a highly promising piece of ground; but there is a lot of work to be done before it can be made a mine—that is on the north lodes; the south mine, on the great tin lode, is of course quite independent, but it requires a high price of tin to make profits. Wheal Union is also a very promising sett, being on lodes parallel to those of East Carn Brea and Great South Tolgus. The great excitement of the county seems, however, to be concentrated on the Caradon district, where mines reach prices that can scarcely be comprehended in the more sober western districts. During the present month the great rise has been in Ludcott, which mine is now selling at 120,000*l.*, on the strength of a discovery of silver. That this discovery is a remarkable and valuable one is undoubted; but that it is such as to justify the present price of the mine is quite another affair. The silver discovered is principally the sulphide of silver, of which crystals have been met with equal to those found in Mexico, and far surpassing any hitherto met with in this country.

The great prices at which East Caradon and other rich and productive mines in this district are selling at is not a matter to be surprised at; but the rates at which certain speculative mines are quoted—concerns which are simply speculations, and some of rather an indifferent class—is really

startling. Our own impression is, and it is a strong and decided impression, that the prospects of success in an immense proportion of the speculative mines of this district are rated far too high by the public, and that the present inflated rates must ultimately bring about a dangerous collapse. The Caradon district is a fine one, but it must be expected to give about the same proportion of blanks to prizes as we are led to expect from the experience of other older districts, equally rich on the whole. The present impression of the public mind seems to be that every thing here must turn up trumps; and consequently every concern with the name of "Caradon" attached to it is eagerly sought for, and reaches prices not justified by any intrinsic merits.

WALES AND THE BORDERS.

South Wales.—In the iron and coal trades of South Wales there seems to be a general impression abroad that things have passed through the most trying ordeal, that the worst has been passed, and that more cheering times and more remunerative prices may reasonably be expected for the time to come. We know this opinion is freely endorsed by one or two of the principal makers, and those engaged in the manufacture of iron in this district; and hence there is greater firmness in the trade than for some weeks past; and, although perhaps no decided advance in price can be noted, merchants are less inclined to sell at the low prices now obtainable. France, Spain, and Italy still continue to take considerable quantities of iron, but other foreign countries do not make large demands upon our supplies. With respect to the coal trade, there is plenty of work for the colliers, and there is every prospect of this being continued for the summer and autumn. Cardiff is doing a good foreign export trade, but the shipping of the other ports is somewhat slack. The trade of the Aberdare Valley, and the whole of the interior of the district, continues good. As to the iron trade, the activity in our mills and forges is quite cheering. To show the increase of trade in this important branch of commerce, we will just make a comparison of the present state of matters at the Gadlys Iron Works, the concern second in magnitude in the Aberdare Valley. On the Gadlys mine bank there was in 1861 a very heavy stock of mine, out of which there was 3,000 or 4,000 tons of rejected mine: at present, we find the stock proportionably low, and the rejected mine has disappeared, while the quantity of gotten mine is on the increase. In 1861, there were only three blast furnaces in operation, making on an average about 225 tons per week, and a stock of iron in the yard of 3,000 tons: at present, there are four furnaces in full work, making on average about 300 tons weekly, with a stock, which is nearly all bought iron, of 250 tons only in the yard. In 1861, there was a slight talk about building a couple of puddling furnaces, but now we find seven new puddling furnaces in full work, and the eighth and ninth fast approaching completion, and to these is added a splendid mill, making all kinds of merchant coke, bars, and rails. There is also now building a new hollow-fire. The make of finished bars in 1861 was only from 15 to 20 tons, while at present it amounts to 60 tons, and in another week will be 80 tons. The books of the Company we are told are crowded with government and other first-class orders, so that the Gadlys workmen may look forward to a season of activity and prosperity. In Monmouthshire both the coal and iron trades continue in a more depressed condition than was generally anticipated. The result is that the principal collieries are limiting their "rise" of coal, which will prevent any large quantity being left on hand. Newport presents an inactive appearance, there being fewer ships in the port than has been the case for some time. This is chiefly owing to the low freights that are offered, especially so when it is considered that nearly all the vessels arrive in ballast. As regards the

iron trade, the future prospects are gradually becoming more encouraging. The iron-cased ships have created an active spirit amongst the ironmasters, and they no doubt look forward to an unparalleled increase of trade when some of the most prominent difficulties now to be contended with are removed.

MIDLAND COUNTIES.

DERBYSHIRE.—The iron trade has experienced a slight improvement lately, and the merchants entertain more hopeful prospects for the future. We have had more encouraging accounts of the state of our colonial trade, and a large proportion of the orders which have been received have been from our colonial possessions. There is a great demand for steam-engine and all descriptions of agricultural machinery, as well as for tools and everything connected with machine-making. At home we have more numerous inquiries for plates and rails than has been the case for some time past. Indeed, there is a better inquiry for iron for railways generally. The firms engaged in the manufacture of armour plates have received further orders from the Government for Her Majesty's Navy. The making of these plates of such remarkable strength and tenacity, has added much to the reputation of Derbyshire iron. It now appears to be only a work of time to bring the manufacture of these plates to a state of still greater perfection. The pig iron trade remains in much the same state that we last reported it. Prices were very unsteady during a portion of the month, but towards the close they were decidedly firmer. The coal trade is very depressed, and there is little prospect of an improvement. The demand from London is a shade improved, but so long as the depression which exists in the provinces prevails, we shall not have an active trade in coal. There is a good demand for Derbyshire hard coal, which is used for locomotive and marine purposes, but other kinds are a drug in the market.

STAFFORDSHIRE AND WARWICKSHIRE.—We are still able to report favourably of the staple manufactures of these districts. How long this may last remains to be seen. That it will not cease with this month there is good reason to conclude, from the fact that there are buyers to a large extent in the home market, who being now engaged in the midsummer stock-taking are not prepared to receive a considerable accession to their present stocks ; but, inasmuch as they want iron and are anxious to begin to use it up so soon as this month has closed, they are forwarding orders which they are desirous should be "placed" for delivery early in July. Such is the extent of the demand throughout these districts for iron of the first-class, that there are few works at which operations are not in some way or other resumed on Monday. By Tuesday a fair proportion of the machinery at most of the establishments is in full work. We have been making a calculation and have arrived at the conviction that, as compared, with say the middle of the quarter, we are now making from fifteen to twenty per cent. more iron in South Staffordshire and East Worcestershire. The descriptions upon which the demand continues to run are plates and sheets, of very varied sizes, but most of them the best qualities. One of the most conclusive evidences of the wide benefit which is now derived from the present demand is found in the fact that a maker who has taken a large order and wishes to obtain assistance in its execution. is unable to secure the help he needs, from the circumstance that his fellows are nearly as pressed for the delivery of the orders they have themselves taken as he is. Bars also continue to rule well, and hoops are healthier. The prices obtained are nearly those of the list for the best iron. In obtaining those rates, first-class houses experience little or no difficulty, notwithstanding that they learn that lower prices, by at least 1*l.* a ton, are being accepted by makers of less repute. Staffordshire iron, of the best quality, will always

receive an amount of favour for numerous purposes which will ever be felt in this district—the permanent prosperity of which will depend for the greater part upon the care taken in the quality. At the present time, greater care is taken of this than at any former period since the establishment of its name, by the ability and skill of the men, whose sons yet remain at the head of the firms which their fathers founded.

NORTHERN COUNTIES.

NORTHUMBERLAND AND DURHAM.—If there be any change in the state of commercial affairs here, it is for the worse, but it is difficult to say whether any alteration has really taken place. This is usually a dull period of the year; the spring orders have been completed, and the autumn orders are to come, so that the apparent dulness may only be the normal condition of the season. The *Newcastle Chronicle*, however, tells us that "the prospect for the autumn and winter months is not so assuring as it was a short time ago. Already many have been discharged from the Elswick works, and it is understood more will follow; indeed, according to present appearances and reports, a large number of the Ordnance works will shortly be laid in. The works of Messrs. R. Stephens and Co. and Messrs. R. and W. Hawthorn, are at present tolerably well employed, but there is no briskness in either establishments, and orders come in very slowly. A reduction in the number of men employed in these works is not unlikely to take place shortly. The other manufacturing works in Tyneside are in much the same state as these we have just mentioned—working, but not busy, and with few or no orders coming in. Altogether the look out in this district is not at all cheering, and it behoves all parties, workmen, tradesmen, and employers to prepare for a period of prolonged depression, by judicious husbanding their resources."

Metal Markets.

THE following weekly reports from Messrs. Von Dadelszen and North, show the position of the metal market during the month:—

May 28th.—The metal market has been very quiet since our last report, but prices have not undergone any change to call for particular remarks.

IRON.—Welsh bar iron is in steady demand, at 5*l.* 2*s* 6*d.* to 5*l.* 5*s.* f. o. b. in Wales, and from 5*l.* 17*s.* 6*d.* to 6*l.* per ton for shipment from this port. Staffordshire qualities remain unchanged, with a fair demand. Scotch pig iron has tended a little in favour of buyers; our present quotations 53*s.* 3*d.* to 53*s.* 4½*d.* cash.

COPPER is very quiet; manufactured is now obtainable at 10¼*d.* per lb., and yellow metal 8⅛*d.* to 8¼*d.*, according to quality. Tough cake and the tile offers at 93*l.* to 94*l.* Banca is quiet; we quote 94*l.* 10*s.* to 95*l.* Kapunda held for 96*l.* Chili has changed hands at 84*l.* in Liverpool, which is above the value at which there are further buyers.

TIN.—English in good demand. Foreign is quiet. Straits with full prompt 115*l.* 10*s.*, and 115*l.* for cash parcels. Banca 122*l.* nom. The Dutch market is dull at 70½ f. Plates still.

LEAD continues firm, at previous quotations.

SPELTER is dull, and transactions restricted for consumption. We quote spot here and in Hull 18*l.* W.H. 18*l.* 10*s.*

June 4th.—We have to report a fair amount of business in the metal market, without any change of importance in prices. There is no doubt business will increase if the harvest prospects continue favourable.

Iron.—Welsh bars remain firm at 5*l.* 5*s.*, f. o. b. in Wales and proportionately f. o. b. here. There is a good demand for first quality Staffordshire iron. Scotch pig iron has had a downward tendency, but during the last few days the market has been a little firmer. Present price 53*s.* 4*d.* cash.

Copper.—There is a good demand for English manufactured, at 10*d.*, at which some business has been done; but the smelters now refuse to sell under 10¼*d.* Tough cake and tile at 91*l.* Not much business done in foreign. We quote Burra 94*l.*, Kapunda 95*l.*, nom. Chili in Liverpool 84*l.*

Tin.—English unaltered, in good demand. Foreign is very quiet. Straits obtainable at 115*l.* cash, and 115*l.* 10*s.* with full prompt. Banca nom. 122*l.* The Dutch market is steady at 70-70½ f.

Tin Plates continue in good demand, at previous quotations.

Lead maintains its position well, with an upward tendency.

Spelter has been very quiet, and no business of importance reported. We quote spot here and in Hull, 18*l.*, W.H. 18*l.* 10*s.*

June 11*th.*—The metal market has undergone but little change. Business is, if anything, a shade quieter. Shippers continue to use great caution in their purchases, and speculation is almost dormant.

Copper.—A large business could be done in manufacturered at 10*d.* per lb., but the smelters refuse to sell under 10½*d.*, which prevents any transaction of importance. Cake, tile, and ingot from 91*l.* to 93*l.* Burra has sold to a fair extent at 94*l.* Kapunda is held at 95*l.* Chili in Liverpool, 84*l.*

Tin.—English is unaltered in value, and in moderate demand. Foreign is quiet, but quotations remain as before, viz.: Banca, 121*l.* nom.; Straits, 115*l.* cash, 115*l.* 10*s.* with full prompt. The Dutch market is dull at 70 f.

Tin Plate makers are pretty well supplied with orders, and the shipments to America continue to be of an average character; prices unaltered.

Lead.—After the sudden rise which we reported last week, the market has become calmer, the demand having somewhat subsided. We quote good soft English 20*l.* 10*s.* to 20*l.* 15*s.*; W.B. 21*l.* 10.; Spanish, 20*l.* to 20*l.* 5*s.*, according to quality.

June 18*th.*—There is but little change to notice in the aspect of the metal market since our last report; the amount of business done has been of an average character.

Iron.—The quotation for Welsh bars remains at from 5*l.* 2*s.* 6*d.* to 5*l.* 5*s.* f. o. b. Wales, with a steady demand, and from 5*l.* 17*s.* 6*d.* to 6*l.* in London. Staffordshire descriptions are unaltered. Scotch pig iron has further receded, closing at 52*s.* 3*d.* cash.

Copper.—English manufactured remains at 10½*d.*, at which some little business has been done. Tough cake and tile is obtainable considerably below official quotations. Foreign sells slowly. Burra, 93*l.* 10*s.* to 94*l.* Kapunda, 94*l.* Chili 84*l.* in Liverpool.

Tin.—Official quotations for English are unaltered, with a fair demand for refined and common. Straits have given way in value during the last few days, influenced by lower prices from Holland. Sales reported at 114*l.* down to 113*l.* cash. Banca nominally 120*l.* The Dutch market is dull, at 68 f.

Tin Plates continue in fair demand, and makers being pretty well supplied with orders, adhere firmly to previous quotations. We quote charcoal from 27*s.* to 28*s.*, and coke from 21*s.* to 22*s.* 6*d.* in Liverpool; 6*d.* per box more in London.

Lead.—The American demand being satisfied, prices are somewhat easier. We quote good soft English 21*l.*, W.B. 21*l.* 10*s.*

Spelter is much neglected, and prices tending downward, sellers now ask 17*l.* 15*s.*, but it is difficult to meet with buyers at this figure. With an accumulating stock we can hardly expect an improvement for some time to come.

Metallic-Ore Markets.

TIN.—The standard for black tin remains unaltered at—

Refined	£102—106
Common	111

The principal event in the tin trade this month was the annual Dutch sale of Banca Tin, which took place at Rotterdam on the 25th of June. The quantity was considerably less than usual, consisting of 142,500 slabs. During the last four years the quantities were:

In 1861 to	149,185 slabs, which sold at	*f.*	69	—
„ 1860 „	151,513 „	„	70	50
„ 1859 „	139,128 „	„	82	50
„ 1858 „	190,842 „	„	68	20

The sale went off well, at from 67½ to 68½ florins. About 155,000 slabs, or 5,812 tons, were offered for sale, which realized 878,333*l.*; to which must be added about 2*l.* per ton for shipping and insurance to England, making a gross amount of nearly 900,000*l.* Comparing the tin standard in the month of June, 1861 and 1862, we find as follows:—

	1861.	1862.
Common tin realized	£112	£101
Refined „	115–117	102–106

The price in 1858 was about 7-10ths of a florin above that of this year; and the average price of black tin, or tin ore, in 1858 was about 61*l.*, or about 20*s.* to 30*s.* over the present prices.

The results of this annual sale (says the *West Briton*)—the most important one that takes place connected with the tin trade, involving nearly a million sterling—gives us reason to hope that no further reduction in the Tin Standard may be expected under the present aspect of political affairs, but that an advancement may be looked for at no very distant date.

COPPER.—At the four Cornish sales we give this month, the number of tons, average produce, quantity of fine copper, average price per ton, and standard, have been as follows:—

Date.	*Tons.*	*Produce.*	*Fine Copper.* Tons. cwt.	*Price per ton.*	*Standard.*
May 29.	4,106	6⅝	271 0	£4 19 0	£116 11 0
June 5.	4,224	6¼	263 16	4 12 0	117 11 0
„ 12.	2,780	6¾	192 6	5 4 6	115 3 0
„ 19.	5,726	6¼	354 7	4 9 6	116 14 0

At the sale of the 29th, according to the *Mining Journal*, there was a decline in the Standard of 3*l.* 12*s.* 6*d.*, but, according to the *West Briton*, of 3*l.* 18*s.* At the sale of June 5th there was a fall in the Standard of 1*l.* 2*s.* 6*d.* according to the *Mining Journal*, and of 1*l.* according to the *West Briton*. At the sale of June 12th the Standard was about stationary. At the sale of June 19th it declined 2*l.*

It will be seen that a heavy continuous fall took place during these four sales, due principally to the large pressure of foreign copper on the market.

London Share-Market.

THE market for mining shares contrasts favourably during the past month with railways, funds, foreign stocks, and the security market generally of the Stock Exchange. In the month Consols have fallen about ½ per cent.; railways, affected by decreasing traffic and the gloomy cotton prospects, have fallen considerably, especially Lancashire and Yorkshire; nearly all the speculative foreign stocks exhibit a decline, while in British mining shares an amount of business unparalled in late years has been transacted, and at quotations showing a marked improvement. New Setons have risen from 95*l.* to 115*l.*, North Phœnix from 7*l.* to 10*l.*, Ludcott from 9*l.* to 23*l.*, East Caradon from 44*l.* to 46*l.*, &c., &c. The hardening tendency in the money market, the drop in the continental exchanges, and the dread of a further advance in the Bank's minimum rate of discount, consequent on the heavy withdrawals of gold on account of foreign commitments, so manifest early in the month, have given place to great ease and a favourable turn generally; so much so, that it is far from improbable that to attract business the Bank Directors, in self-defence, may be driven to put the rate down. Doubtless cheap money, favourable harvest prospects, and towards the close of the month indications of a turn in metals, have something to do with the prevailing activity; but we must seek deeper for the cause of so striking an anomaly as the present state of security markets generally. The spring from whence the activity flows is the large sum of money made during the present year in East Caradon, East Carn Brea, Grenville, &c., the influence of which is widely spread. The constituencies in the two former Companies being large, and having influenced a wide circle of friends, the effect produced on the market generally, is activity where dulness had formerly reigned. The last fortnight has witnessed what would appear to the more calculating as little short of a phenomenon, and has in turn added many to the list of friends of mining. Ludcott, a lead mine near Liskeard, which for several years past has had an unobtrusive existence, on the discovery of a rich bunch of silver, has become the subject of active speculation. An almost uninterrupted rise has taken place in four weeks from 8*l.* to 25*l.* The lead part of the mine has improved; but the silver is that to which chief weight is attached. It was first found in the cross course at the 70, and since at the 60. Below the 70 a winze has been sunk towards the 84, in which there is a fine course of silver, said to be worth 1,000*l.* per fathom. The speculation is in cutting the lode in the 84 and 94 fathom levels below this point.

The dealings in East Caradon have been extensive, the range of prices have been between 42 and 46, finally closing at the highest point. The lode in the 50 and 60 ends on the caunter have not been so rich as formerly; but a course of ore has already been passed through in the 50 for 160 fathoms in length: the end in the 60 is directly under where the lode was poor in the level above, and but now nearing where a sudden improvement took place to 120*l.* per fathom, and

the like may be expected in the 60 any day. The cross-cut at the 70 is thought to be within a fathom or two of the lode. At the meeting to be held in about a fortnight the dividend will be 20*s.* per share which, notwithstanding the fall in the standard, can be kept up, if not increased, for an indefinite period.

East Carn Breas have commanded a large share of attention, fluctuating between 17½ and 19, closing at 17¾-18. At the meeting the assets showed a credit balance, including an ore bill due July 8, of 2,491*l.* The sampling on Thursday last was 435 tons of ore, giving an average produce of 7½ per cent., and has left a profit on working of about 1,000*l.* A new 70-inch cylinder engine was ordered to be erected to work the south lodes, leaving the present engine standing, by which the north lodes will be explored. The three lodes now being worked on are all profitably productive, especially the south lode, which in itself is opening up a rich mine.

Union 4½-⅝ : dealings in these shares have been on a somewhat extensive scale. The lode in the 18 fathom level is 8 feet wide of Gozzan mixed with black ore. The 40, now some distance behind this end, is of a promising character.

Marke Valley, on an improvement in the mine, rose to 11½, but have since fallen back to 9½-10.

Wheal Sithney and Carnmeal 3½-4 : during the month nearly half the mine has changed hands. From the contiguity of this mine to Great Fortune and the near approach of the points at which Great Fortune made rich, the changes are anxiously watched : an improvement has taken place in the lode in the 50 east, and also in the lode in the engine shaft.

Great Fortunes have risen from 25*l.* to 27*l.*, closing 26*l.* to 27*l.*: an improvement has taken place in the lode in the 78 fathom level.

West Tolgus: a rise has taken place from 40*l.* to 50*l.*: the prospects for permanence and profits are good.

North Treskerbys have advanced to 36*l.* The returns from this mine have been considerably increased, and profits are now being made.

Uny 8¾-9: at the meeting a call of 4*s.* per share was made.

Wheal Grenvilles have ranged between 7 and 8½, closing 7¾-8: the caunter lode and the different points of operation have greatly improved.

East Grenvilles have risen to 55*s.*

North Downs, consequent on an improvement in the lode in the winze sinking below the 50, and also in the shaft, have been actively dealt in at 4½-5.

Caradon Consols 14-15: the prospects for discoveries on the lodes in the 68 are favourable. Local parties are the buyers of these shares.

Devon Great Consols steady all the month at 440*l.*

East Russells rose to 6½, fell to 4½, and finally closed 5¼. The improvement is in the 110 east.

Providence quiet at 40*l.*

Wheal Grylls firm at 35-36. Georgia lode in the engine shaft is worth 45*l.* per fathom. On the same lode the winze in the bottom of the adit is worth 50*l.* per fathom.

Cook's Kitchen, after declining to 29 sellers, finally closed 31, buyers.

East Rosewarne has been favourably reported on: price $2\frac{1}{2}$-$\frac{3}{4}$.

Great South Tolgus: buyers at $4\frac{5}{8}$.

Herodsfoot: buyers at 39*l*.

Bryn Gwiog: 25*l*. Several points in this mine are producing large quantities of lead. The last sale for the month was 50 tons.

New Setons find ready buyers at quotations.

North Crofty inquired for at 3*l*.

North Roskear, in consequence of an improvement, have risen to 26-27.

Rosewall Hill: dividend of 3*s*. at the meeting: price $3\frac{3}{4}$-4.

Tincroft quiet at 11-$\frac{1}{2}$.

Wendron Consols, a cheap share 11-$\frac{1}{2}$: dividends will shortly be resumed.

Cliffords have fallen from 32 to 22, chiefly in consequence of the decline in the standard.

Mary Ann 11-$\frac{1}{2}$: this mine continues to make steady profits.

South Frances flatter.

West Basset stationary.

In foreign mines, St. John del Rey have been extensively dealt in: and in new undertakings, Santa Barbara at an advance, finally closing $\frac{3}{8}$ pm. buyers.

We subjoin our usual list of prices of mining shares, corrected up to the latest hour of business.

Bryn Gwiog, 25 to 26; Camborne Vean, 2 to $2\frac{1}{4}$; Caradon Consols, $14\frac{1}{2}$ to 15; Carn Brea, 60 to $62\frac{1}{2}$; Condurrow, $42\frac{1}{2}$ to $47\frac{1}{2}$; Cook's Kitchen, 30 to 31; Copper Hill, $87\frac{1}{2}$ to $92\frac{1}{2}$; Craddock Moor, $27\frac{1}{2}$ to 30; Carn Camborne, 12*s*. 6*d*. to 15*s*.; Devon Great Consols, 435 to 445; East Basset, 41 to 43; East Caradon, 45 to 46; East Carn Brea, $17\frac{3}{4}$ to 18; East Rosewarne, $2\frac{1}{2}$ to $2\frac{3}{4}$; East Wheal Grenville, $2\frac{3}{4}$; East Wheal Russell, 5 to $5\frac{1}{4}$; Gonamena, 3 to $3\frac{1}{4}$; Grambler and St. Aubyn, 16 to 17; Great Caradon, 1 to $1\frac{1}{4}$; Great South Tolgus, $4\frac{1}{2}$ to $4\frac{3}{4}$; Great Wheal Fortune, 26 to $26\frac{1}{2}$; Herodsfoot, $37\frac{1}{2}$ to 40; Hingston Downs Consols, 3 to $3\frac{1}{4}$; Long Rake, 13 to 14; Marke Valley, $9\frac{3}{4}$ to 10; New Birch Tor and Vitifer, 2 to $2\frac{1}{4}$; New Wheal Seton, $112\frac{1}{2}$ to $117\frac{1}{2}$; North Downs, $4\frac{3}{4}$ to 5; North Minera, 15*s*. to 16*s*.; North Roskear, 26 to 27; North Treskerby, 36 to 37; North Wheal Basset, 4 to $4\frac{1}{4}$; North Wheal Crofty, 3 to $3\frac{1}{4}$; North Wheal Robert, $1\frac{1}{2}$; Providence, 40 to 41; Redmoor, 5*s*. 6*d*. to 6*s*. 6*d*.; Rosewall Hill and Rosewall United, 4 to $4\frac{1}{4}$; Rosewarne United, 20 to 21; Sortridge Consols, 9*s*. 6*d*. to 10*s*. 6*d*.; South Basset, $8\frac{1}{2}$ to $9\frac{1}{2}$; South Caradon, 335 to 345; South Carn Brea, 3 to $3\frac{1}{4}$; South Condurrow, 12*s*. to 14*s*.; South C. Wheal Hooper, 18*s*. to 1; South Wheal Frances, $107\frac{1}{2}$ to $112\frac{1}{2}$; St. Day United, 15*s*. to 17*s*. 6*d*.; St. Ives Consols, $27\frac{1}{2}$ to 30; Stray Park, 32 to 34; Tincroft, 11 to $11\frac{1}{2}$; Vale of Towy, 3*s*. to 4*s*.; Wendron Consols, $10\frac{1}{2}$ to 11; West Caradon, 33 to 34; West Condurrow, $4\frac{1}{4}$ to $4\frac{1}{2}$; West Wheal Frances, 11 to 12; West Wheal Seton, 240 to 250; Wheal Arthur, 7*s*. 6*d*. to 12*s*. 6*d*.; Wheal Basset, 85 to 90; Wheal Basset and Grylls, 8 to 9; Wheal Buller, $42\frac{1}{2}$ to $47\frac{1}{2}$; Wheal Clifford, $21\frac{1}{2}$ to $22\frac{1}{2}$; Wheal Edward, $1\frac{1}{2}$; Wheal Grenville, $7\frac{3}{4}$ to 8; Wheal Grylls, 35 to 36; Wheal Harriet, $1\frac{1}{2}$; Wheal Ludcott, 24 to 25; Wheal Margaret, 42 to 44; Wheal Mary Ann, 11 to $11\frac{1}{2}$; Wheal Reeth, 15 to 20; Wheal Seton, 120 to 122; Wheal Trelawney, 13 to $13\frac{1}{2}$; Wheal Union, $4\frac{1}{2}$ to $4\frac{3}{4}$; Wheal Unity Consols, 18*s*. to 1; Wheal Uny, $8\frac{3}{4}$ to 9.

Provincial Share Market.

DUBLIN.—The following report is condensed from the *Mining Journal:* Towards the end of May the Irish Mine Share market was neglected for some days, but on the 28th and 29th it showed signs of reanimation, and the *bonâ fide* dividend-paying mines made another start upwards. Wicklow Copper Company shares were offered at 48*l.* each, and were in request at that price; and Mining Company of Ireland shares advanced from 17*l.* 5*s.* to 18*l.*, being a rise of 15*s.* for the week. General Mining Company for Ireland shares a shade better, and done at 4*l.* 15*s.*; Connorrees flat, at 30*s.* per share, and Carysfort at par (20*s.* paid). The prospectus of the Carbery Mining Company (limited) made its appearance, proposing to raise a capital of 5,000*l.*, in 5,000 shares of 1*l.* each, with power to increase, and to purchase the Gortavallig Mine, on the south side of Bantry Bay.

In the beginning of June a tolerable amount of business was done. The shares of the Mining Company of Ireland were better supported than any others, the highest quotation of last week (18*l.*) having been realized throughout, and an advance of 2*s.* 6*d.*, or 18*l.* 2*s.* 6*d.*, offered for delivery at the middle of the month. Wicklow Copper Mining Company shares steady at last prices, 48*l.*, but scarcely any transactions took place in them. Connorree shares further receded to 29*s.* 6*d.*, and are on sale. Carysfort shares, fully (2*l.* 10*s.*) paid up, fell to 1*l.* 12*s.* 6*d.*, and on sale at 17*s.* 6*d.*, or a reduction of 2*s.* 6*d.* on last prices. General Mining Company for Ireland shares went up to 5*l.*, and holders asked 5*l.* 5*s.*, but since the half-yearly general meeting of this company the price of the shares have fallen to 4*l.* 15*s.*, sellers.

Towards the middle of the month business in mining shares was generally depressed, but the great feature was the sudden fall in Wicklow Copper Mining Company's shares from 48*l.* to 41*l.*, which has been caused by the intelligence of nearly all operations at the mines being suspended. This movement is, however, merely of a temporary character, and in no way detrimental to the interests of the company, as, on account of the large quantities of sulphur which the company has, and can well afford, to keep on hand for a better market, the men have for some time past been kept in full work, from a consideration of the privations which an interruption in their regular employment would entail on the miners, few of whom are provident enough in flourishing times to lay by a trifle to provide for an emergency. The shares of the Mining Company of Ireland alone kept their price, and in demand at 18*l.* 3*s.* 9*d.* Connorree shares down to 28*s.*, and on sale. Carysfort shares (2*l.* 10*s.* paid) weak, at 30*s.*; and so were General Mining Company for Ireland shares, at 4*l.* 5*s.*

Later on in the month the price of Wicklow Copper Mining Company's shares experienced a further drop of 10*s.*, a few having changed hands at 40*l.* 10*s.*; but the shares have since been in steady demand, with a gradual rise from 40*l.* 10*s.* to 41*l.* 15*s.*, and an upward tendency. As not a very large number of these shares were sold at the greatly reduced quotations of the previous week, and there is at present an absence of buoyancy in mining securities generally, the rise in these shares, which may be further expected, will be more gradual than the fall which followed the but partially successful effort to create a panic, although we are now in a position to state that the interruption in the working of the Wicklow Copper Mining Company's mines was only of a few days' duration, the miners having all resumed their usual occupations. The shares of the Mining Company of Ireland were in considerable favour for some days, and rose from 18*l.* 3*s.* 9*d.* to 18*l.* 15*s.*, but receded to 18*l.* 12*s.* 6*d.*, at which price several transactions took place. Carysfort shares (20*s.* paid) were ineffectually offered for sale at 16*s.* 6*d.*, and so were Connorrees at 28*s.*

Tabular Abstract of Mining Accounts for the Month.

Date of Meeting.	Name of Mine, and Number of Shares.	Balances. Debit.	Balances. Credit.	Calls. Per Share.	Calls. Total.	Dividends. Per Share.	Dividends. Total
		£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s.
	CORNISH AND DEVON MINES.						
May 22	Devon Wheal Buller (4,566)...	128 7 6	—	0 5 0	1,141 10 0	—	—
,, 24	East Falmouth (2,048) ...	401 19 7	—	0 5 0	512 0 0	—	—
,, 26	Copper Hill (256)	—	992 5 2	—	—	2 10 0	640 0
,, 26	Alfred Consols (4,943) ...	1,330 8 0	—	0 5 2	1,276 18 10	—	—
,, 26	Wheal Harriett (5,120) ...	237 19 7	—	0 2 0	512 0 0	—	—
,, 27	South Caradon (512)	—	5,384 7 7	—	—	5 0 0	2,560 0
,, 27	South Tolgus (512)	—	703 11 2	—	—	1 0 0	512 0
,, 27	East Bassett (512)	—	1,312 8 11	—	—	1 0 0	512 0
,, 27	East Russell (4,000)	544 11 0	—	0 2 6	500 0 0	—	—
,, 27	Great Work Consols (119) ...	1,293 15 0	—	—	—	—	—
,, 28	Wheal Margaret (896) ..	—	1,837 18 10	—	—	1 10 0	1,344 0
,, 28	Providence Mines (1,120) ..	—	1,392 8 1	—	—	1 0 0	1,120 0
,, 28	Wheal Hearle (1,024) ..	—	963 7 0	—	—	0 5 0	256 0
,, 28	Wheal Tremayne (1,022) ...	534 9 1	—	—	—	—	—
,, 28	Condurrow (256)	5,244 1 2	—	10 0 0	2,560 0 0	—	—
,, 28	Boscean (240)	—	607 5 3	—	—	—	—
,, 29	Craddock Moor (1,055) ...	—	1,551 1 8	—	—	0 4 0	211 0
,, 29	Gonamena (6,144)	73 17 9	—	0 1 6	460 14 0	—	—
,, 30	Wheal Mary (100)	—	237 19 1	—	—	—	—
June 2	Wheal Basset (512)	—	—	—	—	3 0 0	1,536 0
,, 3	Treskerby (512)	—	—	1 10 0	768 0 0	—	—
,, 3	Great Retallack (6,000) ...	565 0 0	—	0 2 0	600 0 0	—	—
,, 4	West Trevelyan (1,827) ...	877 12 9	—	0 8 0	730 16 0	—	—
,, 4	St. Ives Wheal Allen (1,024)...	782 12 10	—	0 15 3	780 16 0	—	—
,, 4	Treylon Consols (572) ...	173 14 5	—	—	—	—	—
,, 5	West Caradon (1,024) ...	—	2,539 11 4	—	—	—	—
,, 5	Treloweth (5,000)	1,049 17 5	—	0 4 0	1,000 0 0	—	—
,, 9	Dolcoath (358)...	—	2,576 4 3	—	—	7 0 0	2,506 0
,, 9	Wheal Seton (396)	—	974 2 8	—	—	1 10 0	594 0
,, 9	Wheal Jane (512)	—	442 1 5	—	—	—	—
,, 9	East Alfred Consols (4,096) ...	823 14 6	—	0 4 0	819 4 0	—	—
,, 10	Wheal Mary Ann (1,024) ...	—	1,781 11 0	—	—	0 10 0	512 0
,, 10	Wheal Norris (6,000)... ...	2,233 3 0	—	0 7 6	2,250 0 0	—	—
,, 10	Cargoll (916)	—	557 0 3	—	—	—	—
,, 10	Charlotte United (6,000) ...	1,710 4 7	—	0 5 9	1,725 0 0	—	—
,, 10	Durlo (1,000)	995 13 9	—	0 10 0	500 0 0	—	—
,, 10	North Busy (1,024)	249 6 6	—	0 5 0	256 0 0	—	—
,, 11	Caradon Consols (914) ...	—	120 9 8	0 10 0	457 0 0	—	—
,, 11	North Crofty (5,610)	554 17 10	—	0 2 0	561 0 0	—	—
,, 11	Wheal Margery (1,024) ...	1,150 15 9	—	0 15 0	768 0 0	—	—
,, 11	East Seton (5,610)	—	154 3 9	—	—	—	—
,, 12	Sortridge Consols (12,000) ...	—	219 14 6	—	—	—	—
,, 12	Kelly Bray (5,000)	214 5 6	—	0 2 6	625 0 0	—	—
,, 13	Spearne Moor (280)	427 15 8	—	—	—	—	—
,, 17	West Seton (400)	—	3,674 15 1	—	—	7 0 0	2,800 0
,, 17	Devon and Cornwall (4,076) ..	690 9 1	—	—	—	—	—
,, 18	Wheal Vor (5,908)	—	2,281 0 4	—	—	—	—
,, 19	Cuddra (6,000)	1,196 16 8	—	0 6 0	1,800 0 0	—	—
,, 19	Bedford United (4,000) ...	—	1,288 18 9	—	—	0 2 6	500 0
,, 19	Hingston Down (6,000) ...	—	42 1 6	—	—	—	—
,, 24	Treweatha (4,096)	1,127 13 0	—	0 5 0	1,024 0 0	—	—
,, 25	East Carn Brea (6,000) ...	—	348 0 0	—	—	—	—
,, 25	Prosper United (6,000) ...	2,528 4 4	—	0 8 6	2,550 0 0	—	—
,, 25	Rosewarne Consols (4,096) ...	—	369 0 0	—	—	—	—
	WELSH MINES.						
May 26	South Darren (6,000)... ...	310 15 3	—	—	—	—	—
,, 27	Garreg (1,000)...	208 17 0	—	0 3 0	150 0 0	—	—
,, 27	Merllyn (4,480)	56 11 2	—	—	—	—	—
,, 28	Dyfngwn (3,000)	—	865 9 0	—	—	0 2 6	375 10

Prices Current of Metals.

From Messrs. JAMES and SHAKSPEARE'S, 10, Austin Friars, E.C.

			Per Ton.						
IRON .... Bars	in Wales ..	£5	0	0	@	£5	5	0
"	" Liverpool	—				5	15	0
"	" London	6	0	0	"	6	5	0
Nail Rods	" Wales ..	5	12	6	"	5	15	0
"	" Liverpool	6	10	0	"	7	0	0
"	" London	6	15	0	"	7	0	0
Hoops (Staffordshire)	" Liverpool	7	15	0	"	8	0	0
" "	" London	8	5	0	"	8	10	0
Sheets "	" Liverpool	8	10	0	"	9	5	0
" "	" London	9	0	0	"	9	10	0
Bars "	" Liverpool	6	15	0	"	7	0	0
" "	" London	7	2	6	"	7	5	0
Scotch Pig (No. 1. g.m.b.)	the Clyde	2	12	0	"	2	13	0
Rails	in Wales	5	10	0	"	5	15	0
Russian	C.C.N.D.	—				—		
Swedish—Hammered—large sizes		—				11	0	0
" "	Indian sizes	11	5	0	"	11	10	0
STEEL .... Hammered—faggot		—				16	0	0
" in kegs ¼ and ⅝ in...		—				14	10	0
COPPER ...... Australian and other *fine* Foreign		94	0	0	"	95	0	0
Foreign Slab, for Prod. 96 per Cent.		—				84	0	0
English Tile and Tough		92	0	0	"	93	0	0
" Best selected		95	0	0	"	96	0	0
			Per lb.					
" Sheets, Sheathing and Rod		10¼*d.*			"	10½*d.*		
" Flat Bottoms		10¾*d.*			"	11*d.*		
YELLOW METAL Sheets, Sheathing and Rod		8½*d.*			"	8¾*d.*		
			Per Cwt.					
TIN .... English .. Common Blocks and Ingots		—				114*s.*		
English .. " Bars (in barrels)		—				115*s.*		
English .. Refined		—				119*s.*		
Foreign .. Straits		112*s.*				113*s.*		
Foreign .. Banca		—				116*s.*		
			Per Box.					
TIN PLATES at Liverpool 6*d.* Less — Charcoal IC, best..............		28*s.*			"	29*s.*		
" IX "		34*s.*			"	35*s.*		
Coke IC		21*s.* 6*d.*			"	23*s.* 6*d.*		
" IX		27*s.* 6*d.*			"	29*s.* 6*d.*		
			Per Ton.					
LEAD.......... Sheet		—				21	0	0
Pig—W.B.		—				21	10	0
" Ordinary brands		20	15	0		21	5	0
" Foreign, soft..............		—				20	0	0
Red		—				22	0	0
Shot		—				23	10	0
Dry White..................		—				27	10	0
SPELTER ...... (Cake)		—				17	15	0
ZINC .... (Sheet)		—				23	10	0
			Per Bottle.					
QUICKSILVER (in bottles containing 75lbs. each)		—				7	0	0
			Per Ton.					
REGULUS OF ANTIMONY, French Star		—				44	0	0

The Metal Market is quiet, but prices are tolerably steady.

TIN.—The Dutch sale of Banca Tin took place 25th instant, and 155,194 slabs were sold at an average of 67¾ fl., about equal to 116*s.* per cwt., laid down here; there are sellers at sale's price. *English* and *Straits* are unchanged.

Copper Ores.

Sampled May 14, and sold at the Royal Hotel, Truro, May 29.

Mines.	Tons.	Purchasers.	Price.
West Caradon	79	1	£5 6 0
	73	4, 6	6 18 6
	68	1, 6	8 12 6
	67	1, 6	11 10 6
	66	9	4 16 0
	61	2, 9	5 12 6
	59	1	4 12 6
	57	2	9 10 6
	43	6	4 10 6
	33	5, 12	1 7 6
Great Wheal Busy	80	12	2 5 0
	70	12	2 7 0
	65	7	2 8 0
	60	12	2 14 6
	55	6	3 4 6
	53	3	3 12 6
	44	12	1 13 0
	40	1, 12	2 6 6
	34	3	2 18 6
	33	6	6 14 6
South Caradon	82	7	5 9 0
	79	8	6 17 6
	72	8	7 2 0
	69	8	5 9 6
	55	8	14 3 6
	51	1, 6	14 17 6
	40	1	6 3 6
Clifford Amalgamated	77	7, 9	3 6 0
	68	3	4 7 6
	54	10	1 19 0
	50	3, 7	3 15 0
	49	10	2 4 0
	32	9	2 8 6
	29	10	3 2 0
	28	10	1 4 6
	16	1	0 5 6
North Treskerby	71	6	5 5 6
	69	6	5 14 6
	67	3	6 6 6
	59	7	3 19 6
	54	3	7 0 0
	19	3	12 1 6

Mines.	Tons.	Purchasers.	Price.
Fowey Consols	81	1	£5 18 6
	77	1, 5	5 15 6
	76	6	5 13 6
	72	1	4 8 6
Tywarnhaile	61	8	2 8 0
	59	7	3 19 6
	58	4, 6, 10, 12	1 18 6
	43	2, 7	2 9 6
	39	6	1 19 0
East Crinnis & S. Par.	82	6	5 17 0
	62	2, 6, 9	4 11 6
	56	2	5 16 0
	50	1	3 13 6
North Downs	65	3	5 18 0
	64	8	5 18 6
	62	6	5 16 6
	42	3	7 10 0
Craddock Moor	82	6	6 5 6
	60	6	5 7 6
	23	1	4 3 0
	11	9	4 16 6
St. Day United	47	3, 7	4 10 0
	36	2, 9	2 6 0
	35	2, 9	3 4 0
	21	10	1 12 6
Wheal Polmear	55	6	2 17 6
	35	6	3 6 6
	16	2	9 9 0
South Crinnis	56	5	2 7 6
	41	9	4 9 6
Perran Mines	38	5	3 7 6
Burra Burra	25	7	3 11 6
	10	1	1 7 0
Duchy and Peru	19	1, 5	1 7 6
	9	1, 5	1 17 6
	5	1, 5	7 0 0
Wheal Rose	27	9	3 4 0
Wheal Jane	20	5	3 17 0
North Wheal Busy	19	6	5 18 0
Wheal Cupid	15	7	4 15 6
Falmouth and Sperries	13	1	2 18 6
Tredinnick's Ore	11	12	0 5 0

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.
West Caradon	606	£3,998 11 6
Great Wheal Busy	534	1,520 9 6
South Caradon	448	3,664 5 0
Clifford Amalgamated	401	1,149 13 0
North Treskerby	339	2,035 5 6
Fowey Consols	306	1,674 10 0
Tywarnhaile	260	675 1 0
East Crinnis, &c.	250	1,271 18 0
North Downs	233	1,438 17 0
Craddock Moor	176	935 11 6
St. Day United	139	440 8 6
Wheal Polmear	106	£425 14 0
South Crinnis	97	316 9 6
Perran Mines	38	128 5 0
Burra Burra	25	102 17 6
Duchy and Peru	53	78 0 0
Wheal Rose	27	86 8 0
Wheal Jane	20	77 0 0
North Wheal Busy	19	112 2 0
Wheal Cupid	15	71 12 6
Falmouth and Sperries	13	38 0 6
Tredinnick's Ore	11	3 0 6

EACH COMPANY'S PURCHASE.

	Tons.	Amount.
1 Vivian and Sons	611	£3,438 14 3
2 Freeman and Co.	237½	1,435 13 0
3 Grenfell and Sons	448¾	2,509 10 6
4 Crown Copper Co.	51	280 13 6
5 Sims, Willyams & Co.	185½	622 5 6
6 Williams, Foster & Co.	944¼	5,369 3 0
7 Mason and Elkington	413¾	1,612 14 3
8 Bankart and Sons	400	£2,737 6 6
9 Copper Miners' Co.	302½	1,207 18 3
10 Charles Lambert	195¾	899 6 9
11 Newton, Keates & Co.	—	—
12 Sweetland and Co.	317	630 14 6
Total	4106	£20,494 0 0

Average Produce, 6⅝.
Quantity of Fine Copper, 271 tons.

Average standard £116 11 0
Average Price per ton 4 19 0

Copper Ores.

Sampled May 21, and sold at Tyack's Hotel, Camborne, June 5.

Mines.	Tons.	Purchasers.	Price.		
Clifford Amalgamated	111	1, 6	£5	5	6
(Wheal Clifford)	104	5	4	11	0
	102	5	4	17	6
	98	5	6	1	6
	90	5	5	14	6
	84	5, 10	3	13	6
	70	5	4	11	0
	58	5	3	11	6
	54	9	3	16	0
	52	2	5	7	6
	48	7	5	2	0
	28	5, 7	3	3	0
(Consols)	49	9	5	7	0
	33	5	6	4	0
West Seton	92	3	7	0	6
	65	7	3	17	6
	61	1, 6	6	19	6
	60	7	4	2	0
	59	3	4	18	0
	58	2, 6	4	12	0
	51	10	2	7	6
	43	2	6	15	6
	42	9	6	0	0
	34	10	0	10	0
	31	12	2	6	6
Tincroft	104	1	0	4	6
	62	10	2	8	0
	52	10	1	15	0
	51	1	4	0	6
	50	1, 6	3	8	0
	49	1, 6	4	13	6
	24	1, 7	5	18	6
	18	5	1	9	0
East Pool	90	1, 5, 6	4	8	0
	64	1, 7, 10	3	16	6
	60	6	4	13	0
	57	12	2	17	0
	51	5	0	11	6
	41	2, 10	2	17	6
Wheal Seton	9	3, 7	3	9	6
(Pendavres)	64	1, 6	4	7	6
	62	1, 2, 3, 6	6	18	6
	56	7, 10	1	5	6
Wheal Seton	53	6	£5	6	0
	44	7	4	6	6
	38	3	13	16	0
South Frances	64	7, 9	5	12	6
	54	9	5	12	0
	42	2	3	13	0
	41	1, 9	7	4	6
	29	1, 2	12	7	6
	24	1	9	15	6
	5	1	3	17	0
Wheal Basset	72	1	5	5	6
	65	1	4	18	6
	49	6	6	18	6
	46	6	5	3	0
	26	10	1	11	0
Condurrow	64	10	2	7	6
	58	7	4	0	6
	54	12	1	19	6
	25	7	4	13	6
South Tolgus	68	3	6	6	0
	60	10	3	7	6
	39	10	3	5	0
East Basset	72	1, 5	5	7	6
	40	1, 5	8	6	6
	34	1, 5	6	14	6
Camborne Vean	68	7	4	13	6
	59	3, 7	3	7	6
Dolcoath	48	2, 6	5	13	6
	40	3	3	12	6
	10	5	1	10	0
Stray Park	68	9	2	7	6
	25	7	7	16	0
Wheal Uny	42	7	5	16	6
North Roskear	38	3, 5	10	0	0
South Basset	35	10	1	19	6
Carn Camborne	25	2	2	1	6
	10	2	6	18	6
West Tolgus	21	4, 6, 9	4	0	0
South Crofty	13	10	1	4	6
	6	8	4	7	0
Crane	7	1	4	12	6
Tryphena Pendarves	2	2	7	0	6

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.		
Clifford Amalgam	981	£4,785	11	6
West Seton	601	2,912	19	0
Tincroft	410	1,035	17	0
East Pool	363	1,229	9	0
Wheal Seton, &c.	326	1,807	12	6
South Frances	259	1,724	13	0
Wheal Basset	258	1,316	9	0
Condurrow	201	608	19	6
South Tolgus	167	757	13	0
East Basset	146	948	13	0
Camborne Vean	123	493	13	0
Dolcoath	89	£432	8	0
Stray Park	93	366	10	0
Wheal Uny	42	244	13	0
North Roskear	38	380	0	0
South Basset	35	69	2	6
Carn Camborne	35	121	2	6
West Tolgus	21	84	0	0
South Crofty	19	42	0	6
Crane	7	32	7	6
Tryphena Pendarves	2	14	1	0

EACH COMPANY'S PURCHASE.

	Tons.	Amount.		
1 Vivian and Sons	682¼	£3,253	15	6
2 Freeman and Co.	299	1,610	15	9
3 Grenfell and Sons	365¾	2,445	14	0
4 Crown Copper Co.	7	28	0	0
5 Sims, Willyams & Co.	829¾	3,791	8	0
6 Williams, Foster & Co.	481	2,518	2	0
7 Mason and Elkington	571½	2,545	3	6
8 Bankart and Sons	6	26	2	0
9 Copper Miners' Co.	326¼	1,539	7	3
10 Charles Lambert	513 5-6	1,298	2	3
11 Newton, Keats & Co.	—	——		
12 Sweetland and Co.	142	341	3	6
Total	4224	£19,397	14	6

Average Produce, 6¼.
Quantity of Fine Copper, 263 tons 16 cwts.

Average Standard £117 11 0
Average price per ton 4 12 0

Copper Ores.

Sampled May 28, and sold at Tabb's Hotel, Redruth, June 12.

Mines.	Tons.	Purchasers.	Price.
West Basset	75	9	£4 12 0
	74	7	4 3 6
	73	9	3 18 7
	71	7	4 16 6
	57	3, 5	7 16 0
	42	8	9 2 6
	39	7	5 8 6
	38	7	6 11 0
	32	5	3 17 6
	24	9	4 9 0
Carn Brea	142	12	0 2 0
	63	3	4 6 0
	62	10	2 16. 6
	59	9, 10	4 7 6
	58	2, 3, 10	2 18 6
	46	3	5 18 0
	44	10	2 8 0
	33	10	2 8 0
Par Consols	82	7	7 13 0
	80	1	8 1 6
	71	7	7 8 0
	35	3	3 16 0
Pendeen Consols	82	1	3 2 6
	70	1	3 13 6
	16	1	18 16 6
	6	5	1 19 0
Charlotte United	41	4, 6	5 14 6
	40	4, 6	8 5 0
	37	4, 6	7 18 6
	30	10	2 2 0
Copper Hill	74	10	1 9 6
	42	2	4 11 6
	7	1	21 1 6

Mines.	Tons.	Purchasers.	Price.
Great South Tolgus	58	3, 4, 6, 7, 9	£4 51 6
	39	3	9 0 6
	23	2	8 13 6
Botallack	53	4, 6	6 10 6
	40	1, 2	13 3 6
	24	2	4 4 6
Prosper United	59	7	4 8 6
	53	2, 6	2 16 0
Treloweth	72	4, 6	4 16 0
	23	5	12 2 0
	13	1	1 6 0
Great Wheal Alfred	48	7	2 0 6
	47	9	1 19 6
West Fowey Consols	82	2, 4, 6	7 0 6
Rosewarne United	42	4, 6	7 15 6
	39	7	4 3 0
Wheal Anna	32	1	1 2 6
	29	9	4 11 6
Wheal Buller	40	1, 6	2 15 6
	16	2	11 1 0
Rosewarne Consols	38	1	10 5 6
	11	1	24 13 6
Wheal Unity Consols	29	4, 6	4 6 0
Wheal Janey	24	1	1 12 6
Pedn-an-drea	17	2	3 5 0
	4	2	6 2 0
Wheal Hearle	20	5	9 5 0
Treffry's Regulus	20	3	11 11 0
South Dolcoath	15	3	11 10 0
Camborne Consols	13	3	9 5 0
Wh. Mary Great Con.	7	5	1 12 0
West Par Consols	5	5	8 14 6

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.
West Basset	525	£2,802 3 6
Carn Brea	507	1,344 4 6
Par Consols	268	1,931 14 0
Pendeen Consols	174	823 4 0
Charlotte United	148	920 19 0
Copper Hill	123	448 16 6
Great South Tolgus	120	828 9 0
Botallack	117	974 4 6
Prosper United	112	409 9 6
Treloweth	108	640 16 0
Great Wheal Alfred	95	190 0 6
West Fowey Consols	82	576 1 0
Rosewarne United	81	488 8 0
Wheal Anna	61	£168 13 6
Wheal Buller	56	287 16 0
Rosewarne Consols	49	661 17 6
Wheal Unity	29	124 14 0
Wheal Janey	24	39 0 0
Pedn-an-drea	21	79 13 0
Wheal Hearle	20	185 0 0
Treffry's Regulus	20	231 0 0
South Dolcoath	15	172 10 0
Camborne Consols	13	120 5 0
Wh. Mary Great Consols	7	11 4 0
West Par Consols	5	43 12 6

EACH COMPANY'S PURCHASE.

	Tons.	Amount.
1 Vivian and Sons	413	£2,677 16 0
2 Freeman and Co.	219½	1,335 15 10
3 Grenfell and Sons	332¾	2,268 10 3
4 Crown Copper Co.	196	1,247 14 5
5 Sims, Willyams & Co.	121¾	876 2 6
6 Williams, Foster & Co.	243	1,377 8 5
7 Mason and Elkington	533	2,840 4 4
8 Bankart and Sons	—	—
9 Copper Miners' Co.	288	1,148 5 6
10 Charles Lambert	291 5-6	717 14 3
11 Newton, Keates & Co.	—	—
12 Sweetland and Co.	142	14 4 0
Total	2780	£14,503 15 6

Average Produce, 6⅞.
Quantity of Fine Copper, 193 tons 6 cwt.

Average Standard £115 3 0
Average Price per ton............ £5 4 6

Copper Ores.

Sampled June 4, and sold at the Royal Hotel, Truro, June 19.

Mines.	Tons.	Purchasers.	Price.		
Devon Great Consols	138	7	£4	4	6
	124	5, 12	4	4	0
	115	10	3	17	6
	114	6	4	12	0
	111	2, 10	3	14	0
	108	7	4	2	6
	107	2	4	1	0
	105	3	8	13	0
	100	9	3	10	6
	99	5	4	14	0
	98	3, 4, 6	7	14	0
	92	3	8	0	6
	87	9	4	14	0
	85	6	4	1	6
	80	10	2	8	0
	73	10	2	4	0
	71	1	8	7	6
	67	10	2	14	0
	66	2, 6	8	2	6
	57	10	2	3	0
	45	6	6	10	0
East Caradon	102	5	3	18	6
	93	1	4	6	6
	90	1	4	19	6
	84	1, 5	8	8	6
	53	5	8	2	6
	23	1, 5	12	12	0
Phœnix Mines	94	2, 6	2	14	0
	82	8	3	6	0
	80	4, 6	3	11	6
	74	8	4	15	0
	50	6	6	5	0
	35	4, 6	8	4	6
	27	8	1	18	6
Wheal Crelake	97	1	4	1	0
	87	6	5	1	0
	71	6	4	6	0
	61	1	2	1	0
	60	10	2	11	6
	37	7, 9	3	8	6
Marke Valley	105	12	2	16	6
Marke Valley	100	8, 12	£3	10	6
	61	6	5	10	0
	60	8	4	12	0
	56	5	2	11	0
Wheal Edward	130	5, 10	2	6	6
	85	8	4	6	0
	30	9	3	15	0
	26	8	8	19	6
Great Wheal Martha	102	1, 5	1	5	6
	90	1, 5	1	0	0
	70	1, 5	1	4	6
North Wheal Robert	96	7, 9	8	5	0
	66	9	1	19	0
	47	7, 8	3	16	0
	21	7, 9	21	2	6
Bedford United	110	2, 6	3	16	6
	102	4, 6	3	14	6
Devon and Cornwall	72	10	1	14	6
	62	7	2	5	6
	57	7	4	12	0
	17	1	11	1	0
Calstock Consols	63	9	3	6	6
	60	9	4	3	0
	36	7	3	2	0
	13	12	2	7	6
Wheal Friendship	84	1, 5	7	12	6
	52	1, 5	2	6	6
	32	4, 6	11	8	0
Wheal Emma	54	8	3	7	6
	51	8	5	10	6
	47	12	1	10	6
Sortridge Consols	71	1, 5, 6	8	16	6
	53	7, 9	5	1	0
Wheal Arthur	76	7, 10	2	7	0
	22	6	3	16	0
Brookwood	64	8	4	7	6
	4	8	17	9	6
Okel Tor	60	10	2	11	6
Fursdon	41	1	7	2	6
Hawkmoor	31	9	4	7	6

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.		
Devon Great Cons.	1,942	£9,417	1	6
East Caradon	450	2 700	1	6
Phœnix Mines	442	1,814	5	0
Wheal Crelake	413	1,543	15	6
Marke Valley	382	1,403	8	6
Wheal Edward	271	1,013	12	0
Great Wheal Martha	262	305	16	0
North Wheal Robert	230	1,542	18	6
Bedford United	212	800	14	0
Devon and Cornwall	208	715	6	0
Calstock Consols	172	£600	19	0
Wheal Friendship	168	1,126	4	0
Wheal Emma	152	535	14	0
Sortridge Consols	124	894	4	6
Wheal Arthur	98	262	4	0
Brookwood	68	349	18	0
Okel Tor	60	154	10	0
Fursdon	41	292	2	6
Hawkmoor	31	135	12	6

EACH COMPANY'S PURCHASE.

		Tons.	Amount.		
1	Vivian and Sons	751½	£3,705	6	2
2	Freeman and Co.	297¾	1,244	2	0
3	Grenfell and Sons	229¾	1,898	1	8
4	Crown Copper Co.	157¾	910	16	11
5	Sims, Willyams & Co.	713¼	3,091	16	2
6	Williams, Foster & Co.	850¾	4,364	12	7
7	Mason and Elkington	566	2,537	0	0
8	Bankart and Sons	600¼	£2,628	8	0
9	Copper Miners' Co.	540¼	2,411	14	0
10	Charles Lambert	742¾	1,930	13	0
11	Newton, Keates & Co.	—	—		
12	Sweetland and Co.	277	835	16	6
	Total	5726	£25,608	7	0

Average Produce, 6¼
Quantity of Fine Copper, 354 tons 7 cwt.

Average Standard £116 14 0
Average Price per ton 4 9 6

Copper Ores.

Sampled May 7, and sold at Swansea, May 27.

Mines.	Tons.	Produce.	Purchasers.	Price.		
Californian	73	22	1	£18	10	6
	68	21¾	7	18	12	0
	65	21¾	7	18	12	6
	61	21¾	7	18	7	0
	60	22	3	18	11	0
	47	21¾	3	18	5	0
	43	21½	14	18	0	0
	59	17⅜	5	14	12	6
Cobre	91	11⅞	7	9	7	6
	90	11⅝	6, 9	9	5	0
	79	11⅝	6, 7	9	1	0
	73	11⅝	5, 6	9	3	0
	59	22	3, 6	17	15	0
	50	21½	5	17	12	0
Berehaven	104	9⅞	2, 7	7	19	6
	100	9¾	3, 6	7	19	0
	118	11½	6	9	4	0
	112	10⅞	3	8	19	0
Cuba	100	12⅜	6	9	15	0
	98	12⅝	6	9	17	0
	90	13	6	9	19	0
	47	12⅞	7	10	5	6
	50	20	5	16	3	0
	32	18⅞	2, 7	15	13	0
	20	18⅝	2, 7	15	9	6
(Precipitate)	5	71½	5	58	0	0
Springbok	55	26	14	22	9	0
	46	27	7	23	2	0

Mines.	Tons.	Produce.	Purchasers.	Price.		
Spectakel	77	39½	2	£33	16	0
Wheal Maria ...	22	23	16	19	10	6
Ookip	53	35	3, 6	29	5	0
	9	35½	5	30	6	0
Bathurst	52	21½	5, 6	17	7	0
	39	23⅛	10	18	13	6
	9	10⅞	2	8	6	0
	5	22⅛	2	18	16	0
Knockmahon ...	81	5½	5, 6	4	1	0
Ballycummisk...	30	4⅞	1	3	4	6
	22	14⅞	1, 7	12	0	0
	18	5⅜	1	4	4	0
	3	26½	7	22	11	0
Seville Ore	25	6⅛	1	4	19	6
	10	23¾	7	8	12	6
	8	14	7	11	14	0
	5	13⅞	7	10	14	0
Connoree (Precipitate)	9	45	5	37	10	0
Cronebane	3	26	5	28	5	0
	2	28	5	23	0	0
Tigrony	3	25½	5	20	18	0
	2	30	5	24	14	0
Glo'ster Slag ..	4	6⅛	2	4	15	0
Slag	1	1¾	16	0	8	6
Yudanamutana	50	28¾	7	22	15	0
	8	22⅞	6	17	13	0

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.		
Californian	476	£8,554	14	6
Cobre	442	4,995	15	6
Berehaven	434	3,712	8	0
Cuba	442	5,226	10	6
Springbok	101	2,297	7	0
Spectakel	77	2,602	12	0
Wheal Maria	22	429	11	0
Ookip	62	1,822	19	0
Bathurst	105	1,799	4	6
Knockmahon	81	£328	1	0
Ballycummisk	73	504	0	0
Seville Ore	48	457	14	6
Connorree Precip.	9	337	10	0
Cronebane	5	109	15	0
Tigrony	5	112	2	0
Glo'ster Slag	4	19	0	0
Slag	1	0	8	6
Yudanamutana	58	1,278	14	0

EACH COMPANY'S PURCHASE.

	Tons.	Amount.		
1 Copper Miners' Co.	157	£1,781	1	0
2 Freeman and Co.	173	3,610	3	0
3 Grenfell and Sons	325	4,669	8	0
4 Crown Copper Co.	—	——		
5 Sims, Willyams & Co.	295	4,621	10	6
6 Vivian and Sons	744½	7,756	14	6
7 Williams, Foster & Co. ...	582½	8,841	5	0
8 Mines Royal	—	——		
9 British and For. Copper Co.	—	——		
10 Mason and Elkington ...	39	£728	6	6
11 Bankart and Sons	—	——		
12 Charles Lambert	—	——		
13 Ravenhead Copper Co....	—	——		
14 Sweetland, Tuttle & Co.	98	2,008	15	0
15 Bold Copper Co.	—	——		
16 Jennings and Co.	31	571	3	6
Total	2445	£34,588	7	0

Black Tin Sales.

Date.		Mines.	Tons.	c.	q.	lbs.	Price per ton £	s.	d.	Purchasers.	Amount of Money. £	s.	d.
May	24.	Great Work	17	9	1	2 ...	—		...	Chyandour	1216	12	6
,,	30.	Cuddra	2	5	3	0 ...	63	2	6 ...	Charlestown	155	0	7
		,, ...	0	5	0	7 ...	42	0	0 ...	ditto			
,,	31.	Basset and Grylls..	24	16	0	0 ...	—		...	——	1420	6	9
		Tincroft	10	3	3	3 ...	62	10	0 ...	R. Michell and Co.	1772	6	1
		,, ...	9	13	0	21 ...	62	10	0 ...	Bolitho and Sons			
		,, ...	8	10	0	20 ...	62	10	0 ...	Harvey and Co.			
June	3.	Gt. Wh. Busy	9	1	2	1 ...	58	12	6 ...	Daubuz and Co.	1040	9	4
		,, ...	1	4	2	9 ...	41	0	0 ...	ditto			
		,, ...	5	17	0	4 ...	58	12	6 ...	Bissoe Co.			
		,, ...	1	7	1	14 ...	57	7	6 ...	ditto			
		,, ...	0	17	3	3 ...	41	0	0 ...	ditto			
,,	4.	Wheal Grylls	17	8	3	2 ...	62	10	0 ...	ditto	1089	18	0
,,	7.	Gt. Wh. Fortune...	24	4	1	27 ...	—		...	——	1650	14	0
,,	10.	Gurlyn	5	7	1	10 ...	63	5	0 ...	Chyandour	339	9	0
,,	14.	Gt. Wh. Vor	23	16	3	25 ...	—		...	——	1604	16	6
,,	17.	Brea Consols	3	19	2	21 ...	69	7	6 ...	R. Michell and Co.	325	14	2
		,, ...	0	12	3	12 ...	63	15	0 ...	ditto			
		,, ...	0	4	0	18 ...	40	0	0 ...	ditto			
,,	18.	Redmoor	4	0	0	0 ...	63	2	6 ...	——	252	10	0
		St. Day United......	35	8	0	1 ...	54	5	0 ...	Harvey and Co.	1920	9	6

Copper Ores.

Sampled May 21, and sold at Swansea June 10.

Mines.	Tons.	Produce.	Purchasers.	Price.		
Cuba	109	12⅞	5	£10	3	0
	106	12¾	3	10	0	6
	105	12⅝	5, 7	9	18	0
	104	12½	7	9	16	6
	101	12⅜	1	9	14	6
(Precipitate S.J.M.)	5	59½	5	46	16	0
	57	20⅞	7	16	11	0
	54	20⅝	5	16	12	6
	5	23½	16	18	6	0
(Precipitate A.V.F.)	2	76½	16	64	5	0
	75	12⅜	1	9	8	0
Cobre	98	12¼	6	9	19	0
	88	12½	3	9	18	0
	66	12⅛	7	9	12	6
	92	12¼	3, 7	9	11	0
	90	12⅝	6	10	2	0
	85	12½	6	9	19	0
	79	12¼	3	9	9	0
	74	19½	16	15	11	0
	9	57	5	46	0	0
	1	26¾	3	21	15	0
Berehaven	103	11¼	10	9	1	6
	102	11⅝	1	9	6	6
	83	10⅞	14	8	15	6
	23	11¼	7	9	1	0
	113	10½	7	8	4	0

Mines.	Tons.	Produce	Purchasers.	Price.		
Wh. Fortune West Aust.	67	23½	5	19	5	0
	65	24⅞	3	19	12	0
	62	22½	2	20	0	6
	57	22⅝	3, 5	18	16	0
	42	25⅜	3	19	6	0
	37	23⅛	11	17	12	6
	56	24½	3	19	3	0
(Gellyreath)	33	22½	7	18	13	0
(Wh. Arrine)	1	18¾	16	15	10	0
Knockmahon	77	5⅞	7	4	6	0
	52	10	6	8	1	0
	100	10⅝	2	8	12	0
	121	5¾	7	4	3	6
Ookip	150	34½	5	29	2	6
	48	34½	6	28	19	0
	47	33½	11	28	5	6
	46	34½	11	29	2	6
Spectakel	52	29½	5	24	11	0
	51	30½	14	25	13	6
West Aust. Mining As.	44	24½	1	19	3	6
	41	24½	2, 6	19	8	0
Worthing	48	56	6, 7	46	11	0
Mines Royal Regulus	29	14	3, 7	11	1	0
Turkish	14	13	6	10	6	0
Seville	9	4⅞	14	3	10	0
Phœnix	•2	3½	1	2	2	6

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.		
Cuba	723	£8,212	12	0
Cobre	682	7,448	18	0
Berehaven	424	3,748	19	6
Wh. Fortune (W. Australia)	420	8,042	19	6
Knockmahon	350	2,114	17	6
Ookip	191	5,514	10	6
Spectackel	103	2,586	0	6
West Australian Mining Assoc.	85	£1,639	2	0
Worthing	48	2,234	8	0
Mines Royal Reg.	29	320	9	0
Turkish	14	144	4	0
Seville	9	31	10	0
Phœnix	2	4	5	0

EACH COMPANY'S PURCHASE.

	Tons.	Amount.		
1 Copper Miners' Company	324	£3,486	6	6
2 Freeman and Co.	182½	2,499	5	0
3 P. Grenfell and Sons	526	6,994	9	6
4 Crown Copper Co.	—	——		
5 Sims, Willyams & Co.	427	7,730	5	0
6 Vivian and Sons	431½	6,198	3	0
7 Williams, Foster & Co.	731	7,423	7	0
8 Mines Royal	—	——		
9 British and For. Copper Co.	—	——		
10 Mason and Elkington	177	£2,085	8	6
11 Bankart and Sons	130	3,320	16	0
12 Charles Lambert	—	——		
13 Ravenhead Copper Co.	—	——		
14 Sweetland, Tuttle & Co.	143	2,069	5	0
15 Bold Copper Co.	—	——		
16 Jennings and Co.	8	235	10	0
Total	3080	£42,042	15	6

Silver Ore Sales.

Date.	Mines.	Tons.	Price per ton. £	s.	d.	Purchasers.	Amount of Money. £	s.	d.
June 10.	Lot 1 (ex *Duadrennan*)	12½	80	10	0	Walker, Parker & Co.	2089	10	0
	„ 2 „	12½	80	10	0	ditto			
	„ 3 (ex *Askalon*)	1	77	0	0	ditto			
„ 5.	Wheal Ludcott	20	31	15	0	——	—		
„ 17.	„	4		—		——			
	„	3½		—		——	—		

Sundry Copper Ore Sales.

Date.		Lot		Tons.	Price per Ton. £ s. d.	Purchasers.	Amount of Money. £ s. d.
May 23.	Parys Mines	Lot 1	(copper ore)	140	7 0 6	J. Radley, jun.	1,723 15
		2	,,	60	5 9 0	ditto	
		3	(precipitate)	19	14 9 6	Sims, Willyams & Co.	
		4	,,	15	4 11 0	C. Lambert	
		5	,,	10	9 0 0	Newton, Keates & Co.	

At Liverpool, by J. Pitcairn Campbell.

Date.		Lot		Tons.	Price per Ton. £ s. d.	Purchasers.	Amount of Money. £ s. d.
June 3.	ex Vencedora ...	Lot 1	(regulus)......	50	43 19 6	Bibby, Sons & Co., and Williams Foster and Co.	11,511 16
		2	(ore)	50	44 1 6	Newton, Keates & Co.	
		3	,,	50	44 13 0	Bibby, Sons & Co.	
		4	,,	57	17 17 6	Sims, Willyams, Neville and Co. Grenfell and Sons Vivian and Sons	
		5	,,	57	18 15 6	Newton, Keates & Co.	
		6	,,	56	18 4 0	ditto	
		7	,,	77	12 15 6	Governor and Co. of Copper Miners	
		8	,,	18	38 19 6	Vivian and Sons	
		9	,,	3	25 19 0	Sims, Willyams, Neville & Co.	

At Liverpool, by Todd, Naylor & Co.

Date.		Lot		Tons.	Price per Ton. £ s. d.	Purchasers.	Amount of Money. £ s. d.
,, 7.	ex Glaramara ...	Lot 1	(ore)	81	12 1 0	Newton, Keates & Co.	8,559 19
		2	,,	81	12 1 6	ditto	
		3	,,	81	12 0 6	ditto	
		4	,,	80	11 17 6	ditto	
		5	,,	80	12 0 6	Bibby, Sons & Co.	
		6	,,	80	12 3 0	Newton, Keates & Co.	
		7	,,	80	12 0 0	ditto	
		8	,,	56	14 7 0	ditto	
		9	,,	56	14 7 6	ditto	
	(Kestrel) ...	10	,,	2½	25 0 0	ditto	
	(Japanese) ...	11	,,	6¾	22 9 6	ditto	

At Liverpool, by Mr. James Hallows.

Date.		Lot		Tons.	Price per Ton. £ s. d.	Purchasers.	Amount of Money. £ s. d.
,, 9.	Den. Brandrett ...	Lot 3	(ore)	102	18 3 0	Sims, Willyams, Neville & Co.	12,672 19
		4	,,	102	18 6 0	ditto	
		5	,,	78	19 12 0	Vivian and Sons	
		6	,,	78	19 15 0	Sims, Willyams, Neville & Co.	
		7	,,	78	19 17 0	ditto	
		8	,,	77	19 13 0	ditto	
		9	,,	77	19 13 0	ditto	
	(Chipica) ...	10	,,	65	20 3 6	Williams, Foster & Co.	

At Liverpool, by Mr. Hardman.

Date.		Lot		Tons.	Price per Ton. £ s. d.	Purchasers.	Amount of Money. £ s. d.
,, 9.	ex Catharina......	Lot 1	(ore)	90	4 3 6	Charles Lambert	739 2
		2	,,	85	4 5 6	J. Keys and Sons	

At Liverpool, by Mr. James Lewis.

Date.		Lot		Tons.	Price per Ton. £ s. d.	Purchasers.	Amount of Money. £ s. d.
,, 10.	Knockmahon......	Lot 1	(ore)	76	9 12 0	Bibby, Sons & Co.	3,139 19
		2	,,	76	9 10 0	ditto	
		3	,,	61	10 7 6	ditto	
		4	,,	60	9 19 0	ditto	
		5	,,	69	9 15 6	ditto	

At Liverpool, by Mr. J. Pitcairn Campbell.

Date.		Lot		Tons.	Price per Ton. £ s. d.	Purchasers.	Amount of Money. £ s. d.
,, 11.	ex Dido	Lot 1	(ore)	36	3 18 6	J. Radley, jun.	326 16
		2	,,	14	9 5 0	Vivian and Sons	
		3	,,	10	5 12 0	Charles Lambert	
	ex Carl Von Truenfell ...	4	,,	64½	3 12 6	James Keys and Son	233 16
	ex Nieta............	5	,,	8½	3 11 6	Charles Lambert	30 7
,, 18.	Parys Mines	——		210	4 16 6	Pascoe, Grenfell & Sons	2,115 5
		——		190	5 16 0	ditto	

Lead Ore Sales.

Dates.		Mines.	Tons.	Price per Ton. £	s.	d.	Purchasers.	Amount of Money. £	s.	d.
May	16.	Round Hill	30	12	3	6	A. Courage and Co.	365	5	0
		Tamar	45	18	12	0	R. Michell and Son	837	0	0
,,	23.	South Exmouth	30	13	10	0	Panther Co.	405	0	0
,,	24.	Harwood	6	11	15	0	London Lead Co.	70	10	0
,,	26.	Newtownards	20	12	16	0	Panther Co.	256	0	0
,,	29.	Wheal Mary Ann	60	24	12	6	Stubbs, Price & Co	1477	10	0
		Westminster	45	11	16	6	Walker, Parker & Co.	532	12	6
		Maesysafn	85	12	6	6	ditto	1047	12	6
		Mount Pleasant	20	11	14	0	Newton, Keates & Co.	234	0	0
		Hendre Ucha	28	12	4	6	Walker, Parker & Co.	477	6	0
		,,	10	13	10	0	Adam Eyton			
		Bryngwyn	21	12	9	6	ditto	261	19	6
		Pant-y-Buarth	12	12	1	0	Walker, Parker & Co.	144	12	0
		Lisbon	10	8	11	6	ditto	85	15	0
		Roman Gravels	35	12	10	6	ditto	438	7	6
		Park	30	12	8	0	Newton, Keates & Co.	372	0	0
		Pool Park	6	12	14	0	Adam Eyton	145	4	0
		,,	6	11	10	0	Newton, Keates & Co.			
June	1.	Bryn Hope	15	13	14	0	Sims, Willyams & Co.	205	10	0
,,	2.	East Logylas	70	12	0	6	Walker, Parker & Co.	841	15	0
		Glogfach	60	14	18	0	Sims, Willyams & Co.	894	0	0
		Cwmystwith	50	12	7	0	ditto	1230	0	0
		,,	50	12	5	0	Panther Co.			
		Goginan	34	16	13	0	Sims, Willyams & Co.	736	10	0
		,,	11	15	4	0	ditto			
,,	3.	Isle of Man Mining Co.	100	14	11	0	ditto	1455	0	0
,,	4.	Bronfloyd	25	13	3	0	Stock and Co.	328	15	0
,,	6.	Dyliffe	66	12	18	6	Walker, Parker & Co.	1008	3	0
		,,	12	12	18	6	ditto			
		Dyfngwm	30	12	4	6	ditto	366	15	0
		Llanerchyraur	15	13	11	6	ditto	203	12	6
		Chiverton	72	16	1	6	Treffry's Trustees	1509	8	0
			40	11	1	0	R. Michell and Son			
,,	7.	Carmarthen United	22½	13	3	0	Sims, Willyams & Co.	383	13	6
		,,	8½	10	6	0	Panther Co.			
,,	9.	North Minera	25	12	6	0	Walker, Parker & Co.	307	10	0
,,	12.	Talargoch (Maesyrerwddu)	77	13	5	0	Adam Eyton	1569	3	0
		(Coetia Llys)	39	14	0	6	Walker, Parker & Co.			
		Deep Level	12	11	11	6	ditto	138	18	0
		Brynford Hall	10	12	10	6	Newtown, Keates & Co.	125	5	0
		Herward United	10	11	13	0	ditto	116	10	0
		Rhosesmor	91	13	4	6	ditto	2393	4	6
		,,	90	13	5	6	ditto			
		Orsedd	14	12	16	0	Walker, Parker & Co.	179	4	0
		Parrys	32	12	15	0	Adam Eyton	408	0	0
		Kilmory	4	12	5	6	Walker, Parker & Co.	49	2	0
		Bryn Gwiog	50	13	3	6	ditto	658	15	0
		Long Rake	16	12	16	6	ditto	205	4	0
		North Henblas	6	11	7	6	ditto	68	5	0
		Pennant	7	12	7	6	Newton, Keates & Co.	149	7	6
		,,	5	12	11	0	ditto			
		Chware Las	9	13	0	6	Walker, Parker & Co.	117	4	6
		Grosvenor	10	12	18	0	Adam Eyton	129	0	0
		Merllyn	3½	12	14	6	Walker, Parker & Co.	44	10	9
		Dyliffe	30	13	2	6	ditto	393	15	0
		Llangynog United	20	12	14	6	ditto	254	10	0
		Lady Eleanor	1	11	10	0	Newton, Keates & Co.	11	10	0
		Pyllanchion	10	12	10	0	Adam Eyton	125	0	0
,,	13.	Cargoll	94	14	1	6	R. Michell and Sons	1323	1	0
,,	16.	Frongoch	45	12	7	6	Walker, Parker & Co.	2241	0	0
		,,	45	12	7	6	Panther Co.			
		,,	90	12	10	6	ditto			
		East Darren	70	15	0	0	ditto	1050	0	0
		Cwm Erfin	21	14	6	0	ditto	759	6	0
		,,	30	15	6	0	ditto			
,,	19.	Foxdale	100	23	16	6	Walker, Parker & Co.	2382	10	0

The sale of *Trewentha*, in last month's *Magazine*, should have been 10 tons, realizing £164.

THE

MINING AND SMELTING MAGAZINE.

AUGUST, 1862.

The North Staffordshire Coal-Field.

BY EDWARD HULL, B.A., F.G.S.

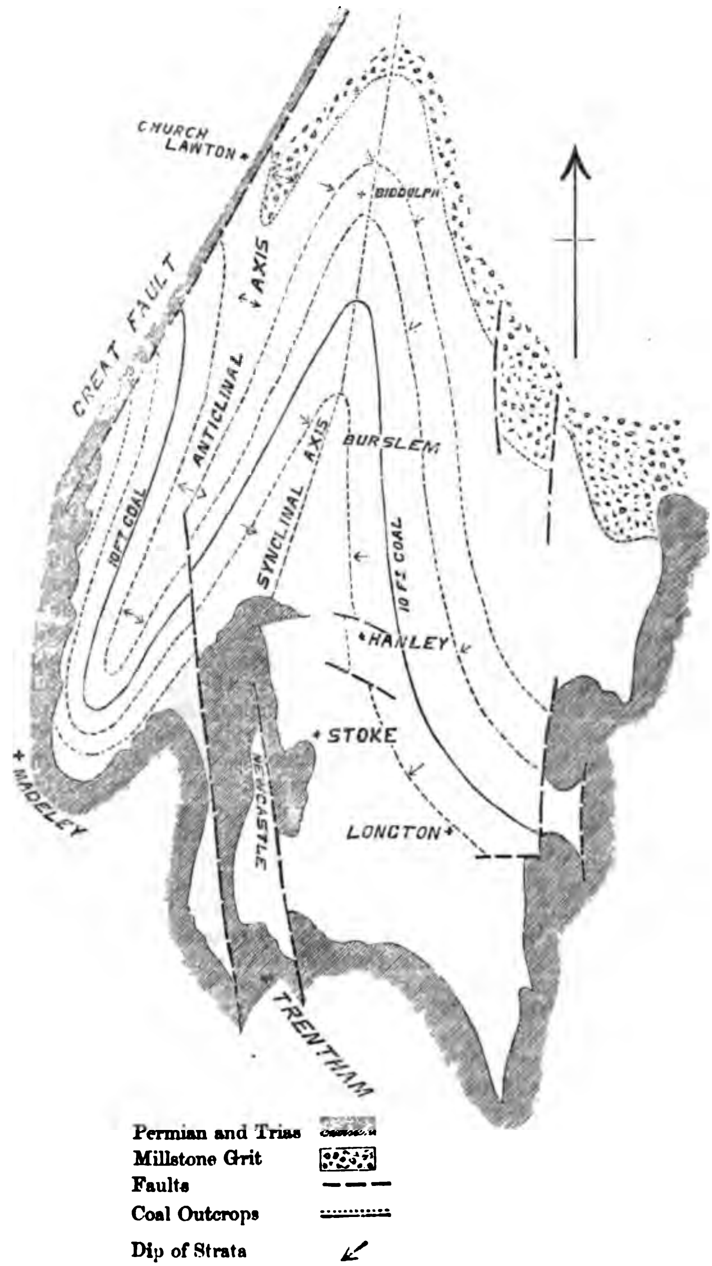
Of the Geological Survey of Great Britain.

THIS Coal-field is remarkable for the variety of its mineral products, and the number and richness of its beds of coal and iron. It is of the general form of a triangle, with its apex at the base of Congleton Edge, and deeply indented along its southern margin by spurs of the Permian formation, which run far up into the heart of the Coal-measures through the agency of faults.* (See map.) In its general aspect this Coal-field is more diversified with hill and valley than the generality of the English mining ground; the bands of sandstone which are interstratified with the softer shales, and the massive red rocks of the Permian formation, produce ridges, separated by wide parallel valleys, which are very conspicuous when viewed from the neighbouring eminences. On these ridges—which are serviceable for drainage and dryness—that cluster of smokey towns, with their groups of funnel-shaped furnaces, known as "the Potteries," are built, and send forth to all parts of the world those exquisitely beautiful wares which are now allowed to be at least equal to the productions of Sèvres and Dresden. While the Coal-measure fire-clays are largely used for the production of coarser pottery and tiles,—decomposing granite from Cornwall and Dartmoor, Chalk-flints from the coasts of the south of England, and Chert from Derbyshire, are imported to the Potteries to form the China-wares, parian figures, and tesselated pavements of Copeland, Wedgewood, and Minton; and the perfection to which these branches of the arts have been brought is now fully attested by the articles at present exhibited in London.

The area of the Coal-field is about 75 square miles, which might be considerably extended if we included all the workable coal which lies under the Permian formation to the south of its borders.

* Maps of the Geological Survey, 73 N.E., and 72 N.W.

SKETCH MAP OF THE NORTH STAFFORDSHIRE COAL-FIELD.



In former numbers of this Periodical we have presented brief, but we believe, faithful sketches of the Coal-fields of Lancashire, Burnley, and North Wales. That of North Staffordshire naturally follows; for without stretching our fancy so far as the old astronomers, we may be allowed to apply the names of body and head to the two first, of right arm to the third, and of left arm to the coal-field which forms the subject of this paper. The North Staffordshire Coal-field is, in truth, a disjointed member of that of Cheshire and Lancashire, re-appearing from beneath the covering of Triassic rocks, under which it had been temporarily concealed.

This Coal-field is divided into two great limbs—an eastern and western—by a promontory of Permian rocks, running up far into its centre by Newcastle-under-Lyne; and in each of these limbs the arrangement of the strata is peculiar to itself. Along the centre of the western limb there runs a sharp anti-clinal axis (see map), stretching from Madeley Heath to Talk-on-the-Hill; and the coal seams dip away in opposite directions on each side of the axis: north of Madeley Heath they bend round and cross from one side of the axis to the other. At the north end of the promontory of Permian rocks the dip again changes, and the beds are bent round to the south-east, and form a synclinal trough, which stretches to the apex of the Coal-field, and forms the "Biddulph trough." After this bend the strata run very regularly from north to south, cropping out in regular succession to the east, till, on approaching the southern borders of the Coal-field near Longton, they are bent round gently to the east, and cast off along the great fault which forms the eastern boundary of the Coal-field at the entrance of Longton Tunnel.

Along the edges of the Biddulph trough the beds are thrown into nearly vertical positions, gradually flattening towards the centre. The trough is enclosed by the high ridges of Congleton Edge and Cloud End, formed of Millstone Grit, and marking in strong outline the boundaries of the Coal-field.

We see, therefore, that the strata have been subjected to forces which have produced several rapid folds which have produced very important changes in the arrangement of the beds.

The general succession of the strata in this district may be thus expressed.

New Red Sandstone.—Soft sandstone and quartzose conglomerates of Trentham-Whitmore: about 600 feet thick.

Permian Beds.—Red and purple sandstones and marls, which are slightly unconformable to the underlying Coal-measures. Thickness, about 600 feet.

Upper Coal-measures.—Grey and yellow sandstones, greenish conglomerates and beds of gravel (possibly of volcanic origin) interstratified with dark purple clays, which are largely used for tiles and pottery-ware. In this group there are several very thin seams of coal of no value. Thickness, about 1,000 feet.

Middle Coal-measures.—Grey and yellow sandstones, clays, shales, with valuable beds of ironstone and coal. Over these the principal collieries are planted. Thickness, 4,000 feet.

Lower Coal-measures.—Black shales and flaggy sandstones, with several thin seams of coal of little value. Thickness, about 1,000 feet. In this division the iron-ore of the Churnet Valley is situated.

The Permian and Triassic formations lap round the western and southern borders of the Coal-field, and may be considered as reserve ground for future mining operations. There are from 12 to 15 miles of country in the neighbourhood of Madeley, Keel, Whitmore, Trentham, Hartwell, and Newcastle, under which coal and ironstone of great value lie at depths less than 2,000 feet; but as a considerable tract of ground occupied by Upper Coal-measures is as yet unexplored, it will probably be long ere collieries advance into the "red rocks," which form their outward skirts.

The Upper Coal-measures, which overlie all the workable coal-beds, form a very well marked group of strata in this Coal-field. They are economically important from the fact of their containing two or more thick beds of purple and variegated clays, which are largely employed in the manufacture of rough pottery-ware, bricks, and tiles. They generally require the admixture of a little sand, and when burnt produce an extremely hard durable material; on this account there are numerous excavations in these clays in the neighbourhood of Madeley Heath, Newcastle, Stoke, and Trentham. These clays are associated with yellowish sandstones and shales, together with beds of greenish gravel and breccia, very different from anything usually found in the coal-formation, and approaching very nearly in appearance to certain beds in the neighbourhood of Hales Owen, in South Staffordshire, which may be referred with great probability to volcanic agency. At Stoke a band of limestone with *spirorbis carbonareus* occurs in a position somewhat similar to that occupied by the Ardwick limestones, near Manchester.

Coal-seams.—The wealth of this Coal-field in coal and ironstone is truly astonishing, and will bear comparison with any Coal-field in the British Isles. There are no less than sixty distinct seams of coal at intervals throughout the 5,000 feet of strata from the Millstone Grit to the "Red Shag" ironstone—that is to say, one seam on an average to every 83 feet of ordinary strata; of these, no less than thirty-four are of a thickness of 2 feet and upwards, giving 147 feet of workable coal.* Let us, for a moment, compare this productiveness with that of several of our richest coal-fields, and we shall then have some just appreciation of the extent which nature has lavished her treasures on this part of our Island. We find that the great coal-field of South Wales has on an average twenty-five seams of 2 feet and upwards in thickness, with 84 feet of workable coal.† That of Somersetshire has twenty, giving 71 feet of coal. That of South Staffordshire six, with 48 feet of coal. That of Lancashire sixteen to eighteen, with 60 feet of coal; and that of Yorkshire fifteen, with 46 to 50 feet of coal. Thus we find that North Staffordshire has 64 feet more coal than South Wales, 76 feet more than Somersetshire, 99 feet more than South Staffordshire, and 97 feet more than Yorkshire. In fact, the only coal-tracts in Britain which approach this in productiveness are those of Scotland; for we

* From a paper by Mr. John Bradbury, jun., on the "North Staffordshire Coal-field." Transactions of the Geol. Soc. of Manchester, 1861–62.

† "Hull's Coal-fields of Great Britain." 2nd edit., p. 74.

find that the Mid-Lothian district has forty-six seams, with 122 feet of coal, and Fifeshire twenty-nine, with 120 feet.* The number of workable seams above stated is rather under than over the average. Mr. Bradbury places the number at thirty-nine, varying from 12 inches to 11 feet in thickness. He adds "when coal-seams are worked in connection with ironstone they are sometimes worked of the former thickness (12 inches); but in computing the number of workable seams I have not taken into account any below 2 feet in thickness, except those that are, and have been worked. It is probable that at no very distant period some of these seams now considered unworkable may be mined to advantage, from the fact of being associated with beds of ironstone and fire-clay.

The following is the general series of coal-seams as they occur towards the northern part of the field. It is scarcely necessary to remark that considerable variations take place in the seams as they are traced from one district to another; but the list here given may, I believe, be considered an average:†—

COAL-SEAMS AND IRONSTONES OF NORTH STAFFORDSHIRE.

	Yds.	Ft.	In.
Black band Ironstone	0	1	6
Strong Bass	14	0	0
Red Slag Ironstone, from 4 ft. to 7 ft. (average).	1	2	6
Coal	0	1	9
Red mine Ironstone, 2 ft. 9 in. *Coal*, 2 ft.	1	1	9
Shale, Coal, and Bass	10	1	6
Strata, with several thin Coal-seams	69	1	2
Bassy mine Ironstone, 4 ft. *Coal*, 1 ft. 6 in.	1	2	6
Little Row Coal	0	2	6
Peacock Coal	1	1	3
Sandy Shale	14	0	0
Spencroft Coal	1	0	6
Fire-clay and shale	18	0	6
Gubbin Ironstone, in bands	1	2	0
Sandstone and Shale	11	0	0
Great Row Coal	1	2	0
Strata, various	28	0	0
Cannel Row Coal	2	0	0
Strata, with Wood Mine Coal, 1 ft. 3 in.	29	1	3
Pennystone Ironstone	0	2	0
Deep mine Ironstone, 2 ft. Coal, 2 ft. 9 in.	1	1	9
Strata, with several bands of ironstone and coal.	44	0	9
Bungilow Coal	0	2	6
Strata, various	73	0	6
Little Coal, 2 ft. *Winghaw* or *Knowles Coal*, 5 ft.	2	1	0
Strata, with several bands of ironstone and coal.	108	1	2
Four-feet Coal	1	0	0
Strata	15	0	0
Rowhurst Coal	3	2	0
Shale, with coal and bass	27	0	0
Burnwood Ironstone, 1 ft. *Coal*, 4 ft. 6 in.	1	2	6
Fire-clay, Rock, &c.	17	0	0
Twist Coal and Cannel	1	0	6
Shale	21	0	0
Coal	0	1	6

* Hull's "Coal-fields of Great Britain." p. 174.

† This section is founded on one given by Mr. J. Bradbury, in his paper published in the Transactions of the Geological Society of Manchester, 1861–62.

	Yds.	Ft.	In.
Various strata	68	1	0
Coal	0	1	0
Strata	58	2	0
Birchenwood Coal	1	0	10
Strata	20	0	6
Mossfield Coal	0	2	10
Shale	12	0	0
Coal	0	2	0
Strata, with coal, 1 ft. 9 in.	66	2	3
Yard Coal	3	0	2
Shale	11	0	6
Ragman Coal	1	0	10
Strata, with coal	25	0	0
Rough seven-foot Coal	2	0	6
Strata, with coal	55	0	0
Stony eight-foot Coal	2	1	0
Strata	31	1	6
Ten-foot Coal	2	0	6
Strata	30	0	0
Sparrow Butts Coal	1	1	0
Strong Shale	15	0	0
Holly Lane Coal	1	2	0
Strong grey Sandstone and Shale	55	0	0
Bowling Alley Coal	2	0	0
Strata	15	0	0
Inferior Coal, in 3 seams	1	0	3
Strata	13	0	0
Inferior Coal, in 4 seams	1	0	7
Shale and Bass	48	0	0
Ironstone mine Coal	0	2	8
Strata	38	0	0
Frogrow Coal, or *Bambury* 7 ft.	1	2	0
Strata	38	0	0
Cockshead Coal, or *Bambury* 8 ft.	3	0	0
Rock and Ironstone-binds	31	0	0
Limekiln Coal	0	2	3
Strata.	48	0	0
Bullhurst Coal	2	0	0
Strata.	20	0	0
Winpenny Coal	1	0	0
Strata, with coal, 1 ft. 6 in.	133	1	6
Silver mine Coal	1	1	9
Black Bass and Shale	52	0	0
Coal	0	2	0
Strata (uncertain)	143	0	0
Crab Tree Coal	1	1	0
Strata, with coal, 1 ft. 5 in.	47	1	5
Strata	14	0	0
Little Row Coal	0	2	3
Strata	74	0	0
Coal	0	1	6

The most valuable seams in the above list are the "Two Rows," the "Winghay," the "Four Feet," the "Birchenwood," the "Stoney Eight Feet," the "Ten Feet," the "Holly Lane," the "Bowling Alley," the "Two Bamburys," the "Bullhurst," and the "Crab Tree" or "Four Feet Coal" of Biddulph. For the following remarks on these seams I am indebted to Mr. Bradbury.

The Birchenwood coal is highly valuable for domestic purposes and for the burning of earthenware.

The Bowling Alley is a very strong coal, and similar to the "Splint" coal of Scotland. It was long considered to be unsuited to the manufacture of pig-iron, but recent trials have proved that this seam, as found at Biddulph, is admirably adapted to such a purpose, and is now extensively employed by R. Heath, Esq., and others, in the smelting of iron-ores. It is, also, one of the best seams for locomotive engines in the district; it frequently reposes on a bed of strong rock without the slighest appearance of anything like fire-clay.

The Two Bamburys are extensively used for coking in some parts of the coal-field, and both are of good quality for domestic purposes.

The Holly Lane is the best house-fire coal in the district, but free burning.

The Bullhurst coal is very irregular. It generally occurs in two seams of 3 feet each, separated by 4 inches of clay; the top seam is, however, frequently absent or very thin, in which case the quality or thickness of the lower seam is not altered.

The Winpenny coal is a seam 3 feet in thickness. It lies on a bed of ironstone, containing a considerable quantity of siliceous matter, and possessing the property of smelting at a very low temperature.

The Silver mine is the lowest workable seam in the middle series; there is, however, another at 52 yards underneath it, of a thickness of 2 feet. The distance between the lowest mines in the middle series and the uppermost in the lower series is 143 yards.

The Four-foot mine, or Crab Tree, is the principal seam in the lower series. It is a good coking coal, and well adapted for the manufacturing of iron in some of its stages. It is now very largely used together with the "Bowling Alley," Stoney Eight" foot, and "Rough Seven" seams for smelting purposes.

Much difference exists in the relative positions of the seams of coal in a very limited area. For instance, at the Stonetrough colliery, near Mow Cop, the "Sparrow Butts," and "Holly Lane" seams are so near each other as to be worked together, forming a mine nearly 10 feet in thickness, known by the name of the "Two Row Coal"; whilst at the adjoining collieries of Bradley Green and and Childerplay, within two miles of the former, the mines are separated by about 15 yards of strata. Nearly all the coal-seams found at Mow Cop and Biddulph are of greater thickness in that locality than elsewhere; they appear to loose their thickness in a gradual or wedge-like form from this point into the centre of the Coal-field.

In the Biddulph trough, from the high angle at which the seams are reared up along the skirts, the yield per acre, surface measure, is enormous, in some places exceeding seven times that of a seam of coal of the same thickness. Mr. Bradbury states that he has measured the angle on different occasions, and in different collieries, as high as 82°. The coal is extracted in "long work," and platforms are erected for the men to stand upon, supported on bars crossing from one side of the seam to the other.

Iron-stones.—The ironstone bands of this Coal-field are no less remarkable for their number and thickness than the coal-seams. The fine specimens of black-band ironstone from the Glasgow Coal-

field exhibited in the International Exhibition could be equalled, if not exceeded, by examples from North Staffordshire. There are no less than twelve workable seams, varying from 9 inches to 7 or 8 feet in thickness; besides these there is the valuable Churnet Valley ore, to which we shall presently refer more particularly. The aggregate thickness of the workable seams of ironstone is upwards of 26 feet.

The "Black-band" Ironstone is the highest seam, and of more than average quality. It is worked at several of the collieries in the neighbourhood of Tunstall, and also at Fenton Park, Silverdale, near Newcastle, and other places.

The "Red Shagg" and "Red Mine" ironstones, a short distance lower, are both the richest and the cheapest to work of any in the whole series. The "Red Shagg" occasionally exceeds 5 feet in thickness, as it has been found so at Tunstall, and at the White Barn Colliery, near Newcastle. These seams, notwithstanding their names, are really ordinary coal-measure ironstones, approaching the character of "black-bands;" they are not peroxides of iron, as might be supposed, their names being, probably, derived from the strata of red clay which overlie them.

Faults.—This Coal-field is affected by several very large dislocations, besides many smaller ones, which are specially abundant along the edges of the Biddulph trough, and at Talk-on the-Hill. One of these forms the boundary of the coal-field along the North-eastern margin (see map).* It appears to commence near Audley and range N.N.E., gradually increasing northward till at Astbury the Carboniferous Limestone is brought up against the upper beds of the New Red Sandstone. The throw of this fault is, therefore, equal to the entire thickness of the Coal-measures, Millstone Grit, and part of the New Red Sandstone, reaching in all, probably 7,000 feet or more.

A large fault passes along the west side of Newcastle, ranging north, towards Talk-on-the-Hill. It has a down throw on the east of about 400 yards (see map). A parallel fault of nearly equal magnitude passes by Hanchurch, near Trentham. East of Longton, a fault bringing in the New Red Sandstone, forms the boundary of the coal-field on the east side. Regarded as a whole, however, this coal-field presents many very clear ranges of coal, admirably fitted for the economical extraction of its mineral treasures.

Resources.—The North Staffordshire Coal-field is as yet far from being opened up to the full extent of its capabilities, yet the production of coal and iron is rapidly increasing. The coal-seams are practically inexhaustible, as they descend to depths of from 5,000 to 7,000 feet along the southern and western margins; but within the limits of 4,000 feet in depth, there is enough of available coal to last at the present rate of production for 700 years.† Between 1857-59 the quantity of coal raised nearly doubled itself, and we learn from Mr. Hunt's "Mineral Statistics of Great Britain," that the produce in 1860 was 2,376,500 tons from 127 collieries.

In the same year 738,229 tons of iron-ore were raised, nearly half

* See Map of the Geological Survey, 73 N.E. and 72 N.W.

† "Coal-fields of Great Britain," p 119.

of which was sent into the southern part of the county; and the remainder smelted in 31 blast furnaces. More than half of this quantity was obtained from Froghall in the Valley of the Churnet. The total produce of pig-iron was 146,950 tons.

THE CHEADLE COAL-FIELD.

Leaving the town of Longton and crossing, towards the east end, a broad strip of high ground composed of Millstone Grit and New Red Sandstone, we find ourselves overlooking a depressed circular plain about four miles in diameter, and bounded on the south by a semicircular range of steep-sided hills formed of New Red Conglomerate. This plain is the Cheadle Coal-Field, and the village which gives it the name stands on the margin of an elevated knoll of New Red Sandstone, which rises, like an island, from the centre of the plain. This Coal-field is but slightly productive—being composed of only the lowest strata of the formation—but near the town of Cheadle the following seams are worked:—

1. Two-yard Coal. This seam has only a very limited range.
2. Half-yard Coal.
3. Yard Coal.
4. Littley Coal.
5. Four-feet Coal.
6. Woodhead Coal, three feet thick.

These seams crop out towards the north, west and east—making a sort of trough—and they ultimately pass below the New Red Sandstone between Dilhorne and Mobberley towards the south.

To the north of the Coal-field rises the high moorlands of the Millstone Grit; and the strata which immediately overlie this formation are finely opened up by the deep channel of the River Churnet, along whose banks there is now in progess a series of mining operations which in a very short time have assumed a position of the highest importance.

The hœmatite of the Churnet Valley was discovered accidentally about eight years ago, and is now extensively mined by galleries along a course of about two miles from Froghall southward. It occurs as a bed or stratum, varying from 6 to 20 inches in thickness, imbedded in red shales of the Lower Coal-measures. Just above the iron-band occur two thin coal-seams, with roofs of black shale containing fossil shells; and about 60 or 100 feet beneath the iron-band is the coarse sandstone of the Millstone Grit; so that the position of this valuable seam is precisely determined.

The Churnet Valley ore differs from the ordinary Coal-measure ores in being a peroxide instead of an arenacious carbonate of iron. Its colour is deep red, and it is also much richer than the richest of the clay ironstones of the neighbouring coal-field. On the other hand, it differs from the hœmatites of the Carboniferous Limestone—such as that of Ulverstone—in being a regular stratum, containing a greater proportion of earthy matter, and presenting no appearance of crystalline structure. The Ulverstone and similar ores of the Carboniferous Limestone have evidently been deposited in pockets or large hollows *formed in* the rock; but the Churnet Valley ore seems to have been *formed with* the rock.

The seam crops out on both sides of the valley and is worked by tunnels driven into the hill; it is thence carried by canal to the coal-districts, and forms a useful mixture with the poorer ironstones, and black-bands of the Pottery district. It may be considered as a hydrated peroxide, and a good sample yielded the following analysis as given by Dr. Angus Smith, F.R.S. :—

Peroxide of iron	68·610
Silica	5·490
Carbonate of lime	18·170
Carbonate of magnesia	3·723
Manganese, alumina, and moisture	4·007
	100·000*

In 1859, the quantity of this ore extraced was 349,000 tons, and in the following year 482,729—so that, notwithstanding the depression in the iron trade, the increase of production has been rapid.

Illustrated Notes on Prominent Mines.

By the Editor.

North Crofty.

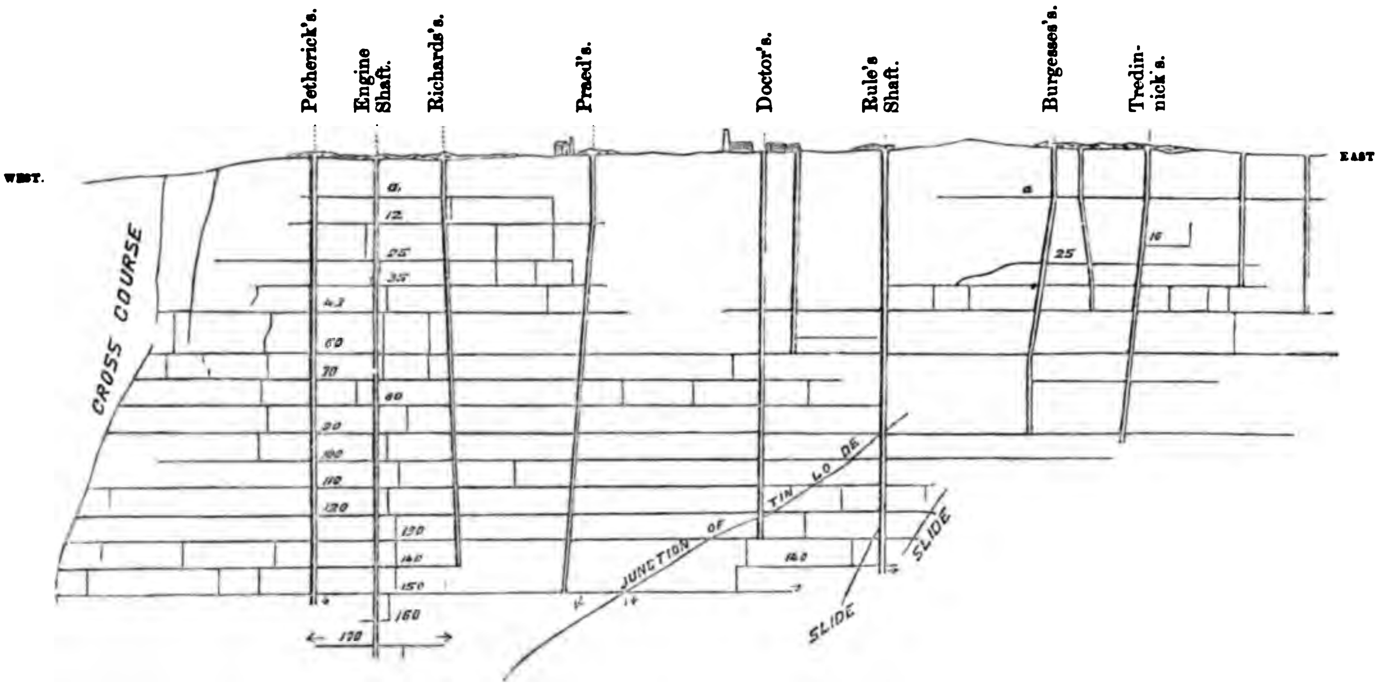
North Crofty Mine is situated in the parish of Illogan, Cornwall, between the towns of Redruth and Camborne, lying about one-third of a mile to the north of the Carn Brea granite range, and of Cook's Kitchen and Tincroft setts, with which it is parallel. The ground was originally worked as Trevenson Mine, after which it was amalgamated with Long Close and Dudnance mines, to the south, and worked as East Crofty. A few years ago the ground was again divided in North Crofty and South Crofty—the former, lying to the north of the turnpike-road, comprising the old Trevenson ground; and the latter, lying to the south of the road (adjoining Tincroft and Cook's Kitchen), including the Long Close and Dudnance ground.

The most important lode in this sett is Reeve's lode, bearing about 25° N. of W. magnetic (or 3° N. true W.), and underlying north from 18 inches to 2 feet per fathom. The other important lodes, to the south of Reeve's, are the Trevenson or Engine lode, bearing about W. 2° N., and underlying north 2½ feet per fathom, which as hereafter stated, falls into Reeve's lode going east; and the Cherry Garden lode, bearing some degrees to the south of west, and underlying south. Above the 10 fathom level, the Trevenson and Cherry Garden lodes are together, and have the same back upwards—at that level they diverge in opposite underlays, the Trevenson dipping north, and Cherry Garden south. To the north of Reeve's lode is Fane's lode, bearing W. 8° S., and underlying north.

The accompanying section (Fig. 1) shows the workings on

* Mem. Lit. and Phil. Soc., Manchester, Vol. xii.

Fig. 1.
SECTION OF REEVE'S LODE AT NORTH WHEAL CROFTY.



Scale, 72 fathoms to 1 inch.

Reeve's lode. In the eastern part of the mine, which was originally worked as Pool Mine, that is, east of Rule's shaft, the lode made considerable deposits of copper above the 43. Between Rule's and Doctor's, the ore made to the 70; between Doctor's and Praed's, it made to the 80; and west of Praed's, the lode was productive to the 100 and even deeper. This dip of the ore is to be accounted for by the junction of the lode with an elvan course, bearing about 12° S. of W., and underlying north 6 feet in a fathom, or at angle of 45°. This elvan course, which is also met with in North Roskear Mine to the west, consequently intersects Reeve's lode at an angle of 37°, and overtakes it in the underlie. The point of intersection between the lode and elvan at surface is in the extreme eastern part of the workings, about Pool Village; but coming west this deepens rapidly, passing through Rule's shaft about the 43, but not being met with in the 60 until about 15 fathoms west of Doctor's, and not at the Engine shaft until about the 150. The copper ore deposits on Reeve's lode evidently made *above* this elvan, and consequently dipped with it. The Trevenson (or Engine) lode makes, it will be seen, an angle of about 23° with Reeve's lode, and (lying to the south) also overtakes it in the underlie. The Engine shaft and Praed's shaft shown in the section, are really sunk from surface on this lode, but the latter comes into Reeve's lode about the 70, although the Engine shaft does not come into it until a little above the 170, although below the 100, the Engine lode dwindles to nothing: Rule's and Doctor's shafts are entirely on Reeve's lode. The Engine shaft is sunk perpendicular to the 12, and below that on the north underlie of the Engine lode to its intersection with Reeve's at the 170. The distances east from this shaft to the point of junction of the two lodes, are as follows, at the levels given: at the 60, 88 fathoms; at the 70, 66 fathoms; at the 80, 52 fathoms; at the 90, 48 fathoms; at the 100, 38 fathoms; and at the 110, 18 fathoms.

Cherry Garden lode has made considerable returns, both above and below the elvan (which intersects it much shallower than it does the lodes to the north), but principally below it. The productiveness of this lode, however, was never anything to be compared with the others.

Compared with the great lodes of the district, Reeve's lode, bearing as it does so much to the north of west, is a strong caunter. Yet it is a lode of great strength, and through its run has been very productive. In the eastern part of North Crofty, it made a magnificent deposit of copper at the old Pool Mine, under the village of that name; and westward, it was also extremely productive at Wheal Crofty, now in North Roskear sett, where it is called the Great Caunter. This lode also goes into Wheal Seton, and altogether it is the main one of this run. East of Rule's shaft, the back of Reeve's lode is in South Crofty sett, but as it underlies north, the deeper parts are in North Crofty sett.

Under the elvan, Reeve's lode thus became poor, so much so, that, although the mine had been sunk by the old party to below the 170, the two bottom levels were abandoned and the water let into the 150, about 14 years ago. It is only within the last month that this has been forked, and the 170 ends commenced driving. The 170

west is now driving by 4 men at 7*l*. per fathom, in a lode from 4 to 6 feet wide, turning out 150 sacks of work per fathom, worth 3 cwt. of tin per 100 sacks, giving 4½ cwt. of tin per fathom. The 170 west is driving by 4 men and 4 boys at 8*l*. per fathom; the lode here is small and poor, but the end is being pushed on to get under the eastern tin ground, to reach which there is about 40 fathoms of ground to drive. In order to ventilate the 170 west, Petherick's shaft has just been commenced to sink below the 150, by 4 men at 7*l*. per fathom. Praed's shaft is also sinking below the 150, by 6 men at at 8*l*. per fathom, to come down on the 170 east; now down 4 fathoms. Until communicated, the water in this shaft will be kept by barrels, and from it an intermediate level—a 160—will be driven east.

The eastern tin ground in North Crofty lies about Rule's and Doctor's shaft. The best end in the mine at present is the 150 east, which is now being driven by 6 men at 7*l*. 10*s*. per fathom. The lode is not large—not exceeding 1 foot—but it produces very rich work, varying from 10 to 12, and 15 cwt. per 100 sacks, up to as high as 22 per 100 for some journeys. The lode produces about 75 sacks per fathom, and for the last 4 fathoms has turned out 2½ tons of tin, which gives a produce of 15 cwt. per 100 sacks, or 7½ per cent.—very rich work. The character of the lode here is also good, although it is small for the district. At the back of 50, to the west of this end, a stope is working by 4 men at 3*l*. 5*s*. per fathom, on a lode from 3 to 4 feet wide, producing work worth 6 cwt. per 100—giving a lode worth about 30*l*. per fathom.

Above this level, the 140 end east is being driven by 4 men at 8*l*. per fathom, on a lode which is now poor and disordered, but has been worth from 10*l*. to 15*l*. per fathom. Under the 120, several stopes are working on a lode producing coarse work for tin. Below the 150, east of Praed's shaft, a winze is sinking by 4 men at 8*l*., in a lode producing a little copper and tin: winze now down between 2 and 3 fathoms.

These are the main points of operation at present at North Crofty. The driving of the 150 east to the slide will be an interesting point: hitherto, in the bottom levels, that is below the 110 where the slide is first seen, the lode has not been traced beyond the slide, which so disorders the ground as to render its recognition afterwards impossible. The driving of the 170 east also, to come up under the eastern run of tin ground is also a point of much importance. It may fairly be doubted, however, whether this run of tin ground in the 150 east is really so important as that met with in the 170 west, where the lode is so much larger, and where the tin seems to continue in the dip of the copper in the upper levels.

Whether, under the rich deposits of copper long since worked away, North Crofty will, like her neighbours to the south, make a profitable mine in depth for tin is a matter upon which as yet it is scarcely possible to speak positively. Tin which would pay to come away was first met with 3 fathoms above the 110, and in that level it made for 50 fathoms long, low quality work. But considering altogether the character of the lode; and taking also into account the recent discovery of granite at East Pool, immediately to the east of

North Crofty, which shows us that we may expect to meet with that rock at a much less depth than we could before have anticipated; the prospects seem decidedly in favour of the mine. Increased depth, however, is probably required, before permanently remunerative deposits of tin are met with, and this will take time; but with time, I can see no reason why North Crofty shall not make a deep tin mine. The first step towards prosecuting the mine in depth has just been taken in forking the water from the 170, and the success which has attended this—a good lode being found in 6 feet driving west—should be an encouragement for further explorations in depth. In this district, tin has only been met with in valuable quantities under the rich copper deposits by sinking through a considerable depth of comparatively poor and unproductive ground; and the key to success seems to be the necessary courage to do this. It may be well to remark that there is probably another elvan—the South Roskear elvan—to be met with in North Crofty in depth.

North Crofty is under the management of Captain Joseph Vivian, so well known as the manager of the adjoining mine of North Roskear. Since he has been here Captain Vivian has had up-hill work, for he took the mine when abandoned by the late adventurers in East Crofty, principally for the sake of North Roskear. From a concern deemed hopeless even by the lords and their agents, for they were the principal adventurers, North Crofty has now been worked into the position of a favourite progressive mine. The other agents are Captain William Thomas and Captain George Bennetts, the purser being Mr. Almond E. Paull, of Camborne.

When Reeve's lode is not productive it generally partakes of a flucany character. It also often makes a flucan part parallel to the main part of the lode, or separated from it by a " horse " of ground. Thus in the eastern part of the mine the tin ground below the 110 has made in connection with, or rather parallel to, a flucan of this kind. At the 120, between Doctor's and Rule's shafts, the old party drove west from the former to the latter on a north flucan branch, missing the main part of the lode; here they cross-cut south 8 fathoms, and cut the main part producing tin, on which the present party have driven back the whole way. As the junction of the east end of the horse of this north flucan with the main part of the lode dips west, at the 130 they are nearly together at Rule's shaft. At the other end of the horse, the junction of the main and flucan parts of lode, at the 120, is just opposite Doctor's shaft, but at the 130, it is 25 fathoms west of this shaft, showing also a rapid western dip of junction. The eastern tin ground seems to make principally on the main part of lode oppose this horse of ground, so its western limit—the junction of the two parts—is shown in the section. The dip of the eastern point of the horse almost coincides with the slide which breaks up the lode. Between these two points of the horse lies the eastern run of tin ground.

WHEAL LUDCOTT.

This mine, situated in the parish of St. Ive, Cornwall, about 3½ miles east of Liskeard, on the Callington road, has been prominently before the public for the last two months, in consequence of a

discovery of silver, which has caused enormous fluctuations in the price of the shares.

The original Ludcott was a lead mine worked on two of the series of approximately north and south lodes which traverse the killas to the south, or south-east, of the Caradon granite range. This original sett was short, and was bounded immediately on the north by Wheal Wrey, a lead mine worked on the same lodes with considerable profit at one time, but which, becoming poor, has recently been sold to the Ludcott adventurers for the value of the materials,—about 3,500*l.* The length of the present united setts of Ludcott and Wheal Wrey is upwards of a mile, a considerable portion of which, in the northern part of Wheal Wrey ground, is as yet unexplored.

The lead workings at Ludcott are, as stated, on two approximating north and south lodes,—the eastern, or main, lode, and the western lode,—which are pretty nearly parallel to each other in bearing and dip, the underlie of both being little more than 6 inches in a fathom east. These two lodes are about 60 fathoms apart, and are intersected by three principal cross-courses, bearing approximately east and west, and all underlying south, about 3 feet per fathom. No. 1 Cross-course (the silver Cross-course) is near Wheal Wrey boundary—indeed, it is entirely in that sett above the 60, below which level it dips into Ludcott. No. 2 Cross-course is about 70 fathoms south of No. 1; and No. 3 is again about 40 fathoms south of this.

The main, or eastern, lode in Ludcott, which is also the lode that has been so productive in Wheal Wrey, is not that on which the first workings in Ludcott were commenced. These were on the western lode, and in the southern part of the sett, where the western shaft is sunk perpendicularly to the 38. At this level the bottom of the shaft is still 10 fathoms to the east of the lode; indeed, with the present underlie of the lode, 6 inches in a fathom, this shaft would not intersect it before the 120. No. 3 Cross-course is to the north of this shaft—about 30 fathoms at the 26—but would fall into it about the 70.

The workings on this western lode seem, for some years, to have been comparatively neglected in favour of the eastern lode; but recently they have received more attention, and are now being prosecuted with vigour. Below the 38, which is the deepest communication from the surface to this lode, it has been opened on by a cross-cut, on No. 2 Cross-course, at the 60. The other level is the 26, which is about 40 fathoms from surface. In all the levels—the 26, 38, and 60 — important ground is being opened out on the western lode, which, considering it is comparatively virgin ground, is consequently one of the most important points of the mine. The 26 north has opened out good lead ground for some length, that will pay to come away, but is now suspended until communicated to the 38 north, which is now just under No. 3 Cross-course, on which a winze is being sunk below the 26, that is now down 9 fathoms. This 38 level north has recently much improved, and has now a good lode, worth 10 cwt. per fathom in the end. This level has not yet come under the run of ore-ground north in the 26, between which

level and the 60 from cross-cut on No. 2 Cross-course the ground is whole. The 38 south also has opened out a large and productive lode, which is now being stoped, but there is no level as yet under this.

The cross-cut at the 60 from the eastern to the western lode is on No. 2 Cross-course, and is 80 fathoms long. On the western lode, opposite this cross-cut, a rise has been communicated to the 38, and from this rise an intermediate level—the 50—has been opened out south, and is now driving on a lode worth 5 cwt. of lead per fathom. This level has not yet been driven north, as it is near the cross-course, up to which it will be stoped between the two levels. The 60 north on western lode is driving by four men at 35*s*. per fathom, and is within 30 fathoms of the No. 1 Cross-course. In this end the main part of the lode is probably missed, but the branch on which it is driving has rather a silver character; and as the cross-course is approached, it is not improbable that silver may be met with here.

The various heaves of the lodes by the cross-courses, and the cross-courses by the lodes, in Wheal Ludcott, are very remarkable, and worthy of a careful study. Indeed, I am not acquainted with any mine where they are so numerous and complicated. In the 26-fathom level, the western lode and No. 3 Cross-course are mutually heaved in rather a curious manner. At its intersection with the cross-course, going north, the lode is heaved 6 fathoms to the right, and after going on in its normal course for 3 fathoms, is again heaved 4 fathoms to the right—10 fathoms in all; while the cross-course is also heaved 2 fathoms to the right. In the level below—the 38—the lode has only one heave of 10 fathoms, and the cross-course continues together.

The eastern lode has been, as I have said, the main lode in this mine, and the one from which the principal returns have been made, although it was not the one on which the mine commenced. It would go beyond my space to describe in detail the workings on this lode; and indeed, as they are a matter of the past to a great extent, it is unnecessary to do so. The principal point at present on this lode, in Ludcott sett, is a piece of whole ground between the two cross-courses untouched below the 70, except that the 80-fathom level has been driven south part of the way, and is now 12 or 14 fathoms short of the cross-course. Below the 70, a winze is sinking on a very good lode, 1 foot wide, worth 30 cwt. of ore per fathom. This winze is now down nearly 7 fathoms, and the 80 end coming up to it is worth 6 cwt. per fathom—so that a valuable piece of ground is being opened up here.

In Wheal Wrey part, on this lode, a good extent of orey ground has been opened out in the 106 south, for 14 or 15 fathoms long, worth 10 cwt. per fathom. This run of ore may fairly be expected to make up to the cross-course which is 25 fathoms a-head. This end had been suspended, poor, by the late management, under the impresssion that the ore dipped north—whereas it really dips south, that is, away from the granite, as is the usual rule In the bottom level—the 116—at Wheal Wrey, the end has been driven into a hard greenstone-elvan and stopped, the intention being to sink the shaft

so as to get under this elvan, when lead may be again expected—ore having been found, under a similar formation, in Wheal Mary Ann, in the same district.

It will be thus seen that the prospects of Ludcott, as a lead mine, are far from being wholly unpromising. A fair extent of ore-ground is being opened out in both mines, on the main lode; but the greatest reliance must be placed on the western lode, which it will be seen is but partially explored in Ludcott ground, and is wholly untouched in Wheal Wrey ground. Whether these together will be able again to produce a permanently profitable lead mine is, of course, a matter for speculation, but certainly they present fair chances of success. In estimating the value of ore-ground, such as I have described, the small cost of taking it away must be borne in mind. The small produce per fathom of some of the most profitable Cornish lead mines are difficult to be understood in other countries; but it is entirely due to the easy nature of the ground which characterizes the lead lodes of that county. At East Wheal Rose, one of the richest lead mines England ever produced, the average produce per fathom scarcely reached 10 cwt.; and in the Liskeard district, the average of the profitable mines would probably be under 6 cwt.

It is not to its position as a lead mine, however, that Ludcott owes its present notoriety. The recent extraordinary rise in the shares—and the equally extraordinary fluctuations—are due to a silver discovery made at the 70 and 84 fathom levels, at the junction of the main lode with No. 1 Cross-course. The position of this silver discovery is best shown by the three woodcuts (all on a scale of 5 fathoms to 1 inch) on the following page—Fig. 2 being a section on the course of the cross-course, and across the lead lode, and figs. 3 and 4 being ground plans of the workings at the 70 and 84-fathom levels respectively. The dotted portions show the silver ground.

By these it will be seen that, at the 70 and 84, the lead lode is heaved 3 fathoms to the left by the cross course, which is also about 3 fathoms wide. Besides this main heave, an intermediate part of the lode is heaved another 9 feet further to the left, remaining in the cross-course. In the 70, the principal bunch of silver made between the main heave in the back of the level, on the north wall of the cross-course: in the bottom of the level it made further west, going down about the intermediate part of the lode, on which a winze has been sunk and communicated to the 84. In the 70 East on the cross-course, another shorter and much less rich bunch of silver has been met with, which seems also dipping west.

It is remarkable that the rich bunch of silver in the back of the 70 never made quite down to the level, which was itself poor. It made just above the back, and was discovered by the ground—which is very flucanny and heavy—falling down. In the winze below the 70, the silver has been followed down 6 fathoms, where the rise from the 84 is come to: in this rise no silver of any very great importance has been met with, as it has gone up rather to the south of the argentiferous ground. By the plan given in fig. 4 of the workings at the 84, it will be seen that at that depth two levels

Fig. 3.

Plan of workings at 70-fathom level.

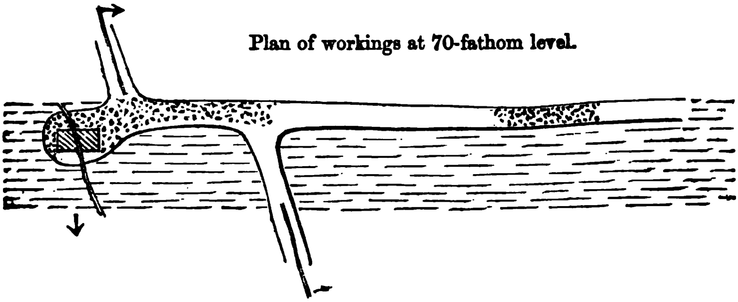
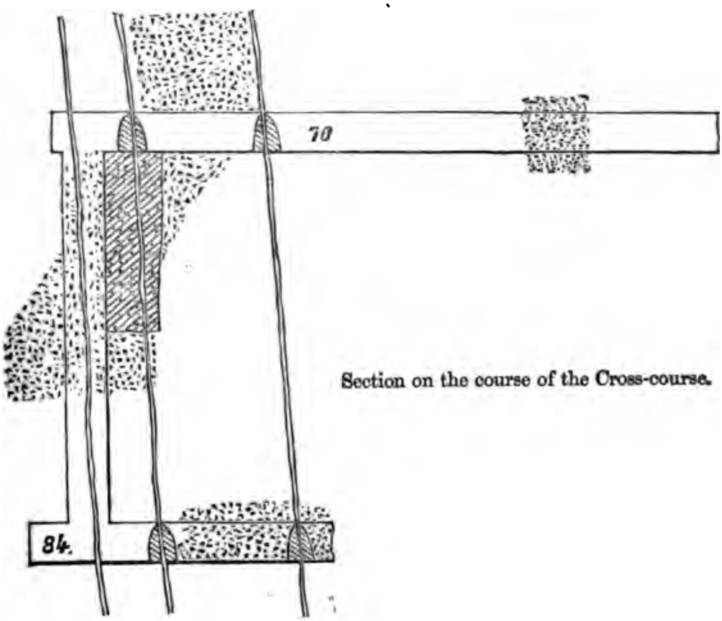


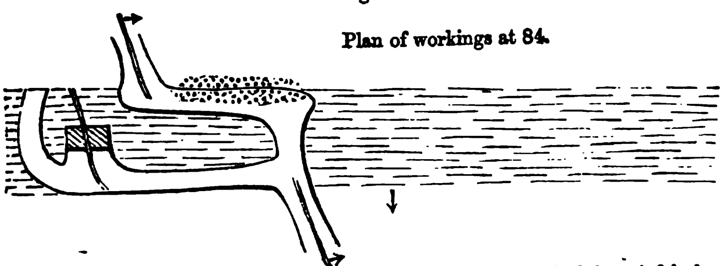
Fig. 2.



Section on the course of the Cross-course.

Fig. 4.

Plan of workings at 84.



Scale of 5 fathoms to 1 inch.

are driven on the cross-course—one on the north, and the other on the south part. When the level on the south part got beyond the intermediate division of the lode, it was turned, as shown in the plan fig. 4, and driven north, but no silver was met with. It is suggested, and may probably be the case, that as the silver dips west it may yet be found, in the 84, further west than that level has been yet driven; however this may be, the continuation of the rich silver bunch in the 70 has not, up to the present time, been discovered in the 84. Recently, however, another run of silver ground, of much poorer quality, has been found in this level, on the north side of the cross-course, between the two main parts of the heave. This silver, from its character and locality, seems a continuation of the eastern bunch in the 70, dipping west.

The rich bunch of silver below the 70, through which the winze has been sunk, is certainly a very remarkable one. The silvery part of the cross-course is in places from 2 to 3 feet wide, largely interspersed with vitreous silver (sulphide of silver, or argentite), and worth probably, at points, more than £1,000 per fathom. At the richest points the sulphide is the principal ore, but a considerable quantity of native capillary silver is also met with, and also some fine crystallized specimens of ruby silver (antimonial silver, or pyargyrite). The silver, of whatever kind, is almost invariably accompanied by a considerable proportion of white iron, with which it seems to have some distinct relationship. In the eastern bunch of silver in the 70, and new bunch in the 84, there is but little sulphide, the silver found there being generally native, and, consequently, in much less quantity, and of much less value, than the rich western bunch.

The following are the particulars of the quantity of silver ores already returned, amounting to £10,123 13*s*. 6*d*. There is probably, at least, as much more broken and discovered.

Silver Ores Sold at Wheal Ludcott for Nine Months.

Date.	Weight. Tons.	c.	q.	lbs.	Price per Ton. £	s.	d.	Amount. £	s.	d.
1861. Sept. 20 ……	3	0	0	0	290	0	0	870	0	0
„ 27 ……	10	0	0	0	47	6	0	473	0	0
Nov. 13 ……	10	0	0	0	34	10	0	345	0	0
1862. Jan. 4 ……	25	0	0	0	2	0	6	50	12	6
„ 18 ……	1	0	0	0	694	0	0	694	0	0
Feb. 22 ……	1	4	2	0	652	0	0	896	14	0
Mar. 1 ……	13	0	0	0	25	7	6	329	17	6
„ 22 ……	10	0	0	0	1	7	6	13	15	0
„ 27 ……	2	0	0	0	457	0	0	914	0	0
April 3 ……	1	2	0	0	235	0	0	258	10	0
„ 9 ……	1	18	2	0	367	6	6	707	2	0
„ „ ……	14	0	0	0	33	15	0	472	10	0
May 10 ……	3	10	0	0	378	0	0	1,323	0	0
June 5 ……	20	0	0	0	31	15	0	635	0	0
July 1 ……	4	0	0	0	464	0	0	1,856	0	0
„ „ ……	3	10	0	9	80	15	0	282	12	6
Total ……	..				..			£10,123	13	6

G 2

WHEAL METAL (GREAT WHEAL VOR).

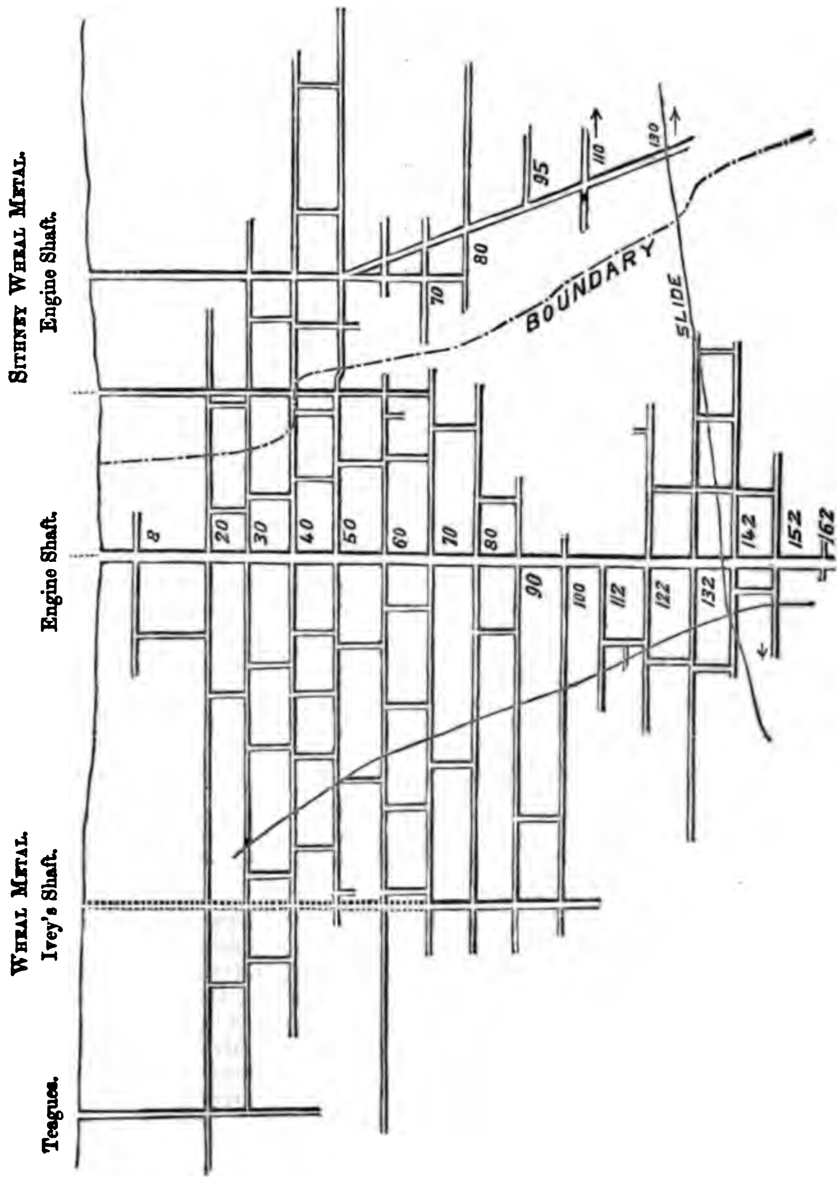
Wheal Metal mine, situated in the parish of Breage, Cornwall, is worked on lodes parallel to those of Great Wheal Vor, further south. Great Wheal Vor, a mine 323 fathoms deep from surface, which in its palmy days made the greatest returns of tin ever yet known in the county, was—as most of our readers probably know—reworked some years ago by a London company with disastrous results. Wheal Metal was included in the same sett, and worked by the same adventurers; but the results, in the two cases, were very different, for while the old mine made a loss of hundreds of thousands of pounds, Wheal Metal gave very excellent profits—profits, however, which were swallowed up in the ocean of loss incurred by the old mine.

When it was determined to abandon Wheal Vor proper, the adventurers—or what remained of them—decided to continue the working of the south mine, Wheal Metal. But although a rich mine, this at the beginning involved some difficulty, inasmuch as the entire pit-work had to be changed. Relying on the old mine, which to a certain extent drained the ground at Wheal Metal, the pumps at that mine were small. When the old mine was abandoned, instead of this aid being continued, the water came back the other way, so that much increased pumping means became necessary. Although Wheal Vor proper has been abandoned, the name has still been continued as applied to Wheal Metal, as the ground is all in one sett.

The accompanying section (fig. 4) shows the workings at Wheal Metal, and at the adjoining mine of Sithney Wheal Metal, wrought on the same lodes closely adjacent. In these mines there are two lodes—the Metal lode, and Schneider's lode. The former made rich tolerably shallow, and has also been very rich in the bottom levels, particularly the 152; Schneider's lode did not do much above the *slide,* which is shown traversing the mine with a slight westerly dip; but under the slide it made very rich. Indeed, altogether the courses of tin met with in Wheal Metal exceed in richness any recently formed in Cornwall: if this mine all through had been worked vigorously, and independently of old Wheal Vor, it would have been distinguished as one of the great modern successes of Cornish mining. As it is, the greater proportion of its profits have been swallowed up in the old mine; and even since its separate working it has been weighed down by difficulties which have to some extent prevented its vigorous development.

It is not possible to ascertain exactly the returns of Wheal Metal during the present working, for in the early part of the working they were purposely confounded with those of the old mine, in order to put a good face on the latter. As far as they have been kept separate, the books show a return from Wheal Metal of 122,735*l.* 19*s.* 7*d.* The real total may be about 150,000*l.* The following particulars give the quantities of tin raised each month from the Metal engine shaft, in sinking from the 60 to the 132, on the lode. This shows 61 tons 10 cwt. 1 qr. 22 lb. raised from 72 fathoms of sinking. From the 30 fathoms below the 132 to the 162, the lode having been thrown out of the shaft by the slide, the raisings (from branches) were only 1 ton 12 cwt. 1 qr. 18 lbs.

SECTION OF WHEAL METAL AND SITHNEY WHEAL METAL MINES.



Scale of 40 fathoms to 1 inch.

GREAT WHEAL VOR UNITED MINES.

Black Tin raised in Sinking Metal Engine Shaft from the 60-fathom Level to the 132.

		Tons	cwt.	qrs.	lbs.
1855.	March..	0	9	1	3
	April	3	9	0	7
	May (below the 60-fm. level) ..	1	4	3	9
	July	0	10	1	22
	August	5	19	1	2
	September (below 70 level)	0	19	0	3
	October	0	13	0	14
	November	0	9	3	17
	December	1	0	0	20
1856.	January	1	7	0	21
	February	5	1	1	14
	March..	4	2	0	12
	April	1	6	3	12
	May (and end south of 80)	1	14	2	15
	June	0	7	1	15
	July	0	11	0	22
	August (below 82 level)	0	0	3	23
	October	2	5	0	21
	November	15	16	2	25
	December	1	10	2	14
1857.	January	4	10	2	21
	February	1	16	0	20
	March..	0	8	2	13
	April	0	2	3	21
	May	0	1	3	1
	June	0	2	3	25
	July	3	2	3	13
1858.	August (below 130)	0	0	0	27
	September „	0	0	1	15
	October „	0	8	3	17
1859.	July (below 122)	0	12	3	17
	August „	2	6	3	6
	September „	1	17	1	16
	October (and end at 132 east) ..	1	17	1	16
	Total	61	10	1	22

Note.—About 8 fathoms below the 132 fathom level to the 162, the lode was heaved south by a slide. The tin sampled from the shaft below that depth only amounting to 1 ton 12 cwt. 1 qr. 18 lbs., was raised from branches passing through.

In Sithney Wheal Metal mine, the shaft, as will be seen, is down to the 130, just under the slide. This shaft has been sunk by the present party from the 50 on the diagonal underlie of the lode and cross-course, which keeps it clear of the boundary; the lode it is sunk on is probaby Schneider's lode, and the object has been to sink down under the slide before driving. The shaft itself is no trial, being sunk on the cross-course, about the immediate neighbourhood of which nothing could be expected. A cross-cut is now driving at the 110 to intersect Metal lode, which may now be expected to be cut any day. Although this mine has not yet been successful—indeed, it would have been impossible for any result to be arrived at yet, for nothing has been done but to sink the

shaft on the cross-course—it is a first-rate speculation, from which we may anticipate great results. This is to be sincerely hoped for, for the mine is worked almost entirely by Mr. William Burgess, of Camborne, and his family,* who have already spent 6,000*l*. on the concern. Through a long life Mr. Burgess has been a most enterprising and successful mine adventurer: of his enterprise no greater proof can be afforded than that (at his advanced age of upwards of 80) he and his family should enter into, and carry on, nearly nineteen-twentieths of Sithney Wheal Metal.

The International Exhibition, 1862.

Class I.—Mining, Quarrying, Metallurgy, and Mineral Products.

The following is a list of the awards of Medals and Honourable Mentions in Class I, with a list of the Jurors:—

JURORS.

Igino Cocchi	Italy	Professor of Geology at Florence.
Charles Combes	France	Member of the Institute, Inspector General, and Director of the School of Mines.
J. A. C. das Neves Cabral	Portugal	Inspector of Mines.
Lt.-Gen. Alex. Gerngross	Russia	Director of Mining Department.
Sir W. Logan	Canada	Director of Geological Survey of Canada.
Francisco Luxan	Spain	Senator.
Sir Roderick Murchison, F.R.S., F.G.S. (Chairman)	London	Director-General of the Geological Survey and of the Government School of Mines.
C. Overweg (Dr. Wedding, proxy)	Zollverein	Landowner, Letmathe.
J. Percy, M.D., F.R.S., F.G.S.	London	Professor of Metallurgy to the Government School of Mines.
Warington W. Smyth, M.A. F.R.S., F.G.S. (Secretary)	London	Professor of Mining to the Government School of Mines.
Tho. Sopwith, F.R.S., F.G.S.	Newcastle	Mining Engineer.
K. Styffe	Sweden	Director of the Royal Polytechnic Institution, Stockholm.
Peter Tunner	Austria	Director of the Imperial Mining School in Leoben.
A. de Vaux (Deputy Chairman)	Belgium	Member of the Department of Science of the Royal Academy of Belgium; Inspector-General of Mines.
H. Hussey Vivian, M.P., F.G.S.	Swansea	Mine Owner.
Nicholas Wood, F.G.S.	Newcastle	President of the Northern Institute of Mining Engineers.

ASSOCIATES.

Daubree	France	Engineer-in-Chief to the Imperial Corps of Mines. Juror, Class 31.
Dubocq	France	Engineer to the Imperial Corps of Mines.
J. Oakes	Alfreton	Ironmaster. Juror, Class 31.

AWARDS—MEDALS.

Aberdare Iron Company—For model of a blast furnace, yielding an extraordinary quantity of pig-iron, and for specimens illustrating the manufacture of rails.

Barker, Rawson, and Co.—For a collection of de copperised lead and slag lead, softened by a new process.

Bell Brothers—For the production of aluminum in large quantities, illustrated by a collection of its preparation from the ore, and its application to various useful purposes.

Bickford, Smith, and Co.—For maintaining the excellence of the safety-fuse originally introduced by them.

Birley, S.—For his skilful application of a great variety of mineral substances to ornamental purposes.

Blaenavon Iron and Coal Company—Pig and manufactured iron, of excellent quality, especially for solid rolled welded tyres.

Bolckow and Vaughan—For economy of production, and the development of a new district.

Bowling Iron Company—For an instructive collection, and excellence of quality.

Brown and Jeffcock—For map exhibiting the outcrop of the seams of coal in South Yorkshire, illustrated by specimens and sections.

Brown, J. and Co.—For large rolled armour-plates.

Butterley Co.—For novelty and excellence in the working of wrought-iron of large scantling, especially for the welded girder, rolled engine-beam, and rolled deck-girder.

Cheesewring Granite Company.—For successful development of the granite of the Liskeard district, and its application to a monolith, exhibited with reference to the proposed monument of the Exhibition of 1851.

Coalowners of Northumberland and Durham—For the valuable series of maps and sections—principally constructed by Mr. Oliver—of the Northern coal-field, with its relations to underlying and overlying formations.

Courage, A., and Co.—For a collection of specimens illustrating the Belgian process of extracting zinc.

Crawshay, H., and Co.—In recognition of his spirited sinking of a shaft of large dimensions, and fitted with pumps of 27-in. diameter, for winning the iron ore.

Daglish, J.—For application of a long-heating surface, capable of increasing the ventilating power of a colliery furnace when needed.

Dowlais Iron Company—Rolled girders and rails, especially the girders, 15-in. deep and 30 ft. long.

Eastwood and Sons—For good quality of the iron exhibited.

Ebbw Vale and Pontypool Companies—For iron of very superior quality, and for a process of carburetting wrought-iron scrap, whereby the phosphorus is practically got rid of.

Evans and Askin—For excellence of manufacture of nickel and German silver, also of pure oxide of cobalt, first obtained by them as a commercial product.

Farnley Iron Company—For iron of excellent quality, especially the piece of thick plate, bent cold, and re-bent at right angles.

Forster, G. B.—For exhibition of the details of an excellent form of cage, fitted to rolled iron guides.

Freeman, W. and J.—For the great and successful development of the granites of Penryn and Lamorna, and the fine polished columns and specimens exhibited.

Geological Survey of the United Kingdom—For the highest merit in the published delineations and descriptions of the geological structure of the United Kingdom.

Governor and Company of Copper Miners—For specimens of copper, tin plate, and iron, showing skill in manufacture, and good quality.

Gowans, J.—For successful application of his borer, and of galvanic blasting to quarries worked on a large scale.

Granville, Earl—For good products and fine specimens of minerals representing very important workings, and for the section of which the data are given by his deep sinkings.

Greaves, J. W.—For excellence of quality and skill in working, and for his slate-dressing machine.

Greenwell, C. G.—For sections and specimens well illustrating the Somersetshire coal-fields and the remarkable iron ore of Westbury.

Henderson, J.—For well-executed maps on a large scale of the workings of several Cornish mines.

Hewlett, A.—For an excellent section of the sinkings to this remarkable bed of Cannel, and the fine specimen of the seam exhibited.

Higgs, S., and Sons—For plans of mines and carefully collected series of ores and accompanying rocks of the St. Ives and St. Just districts.

Hird, Dawson, and Hardy (Lowmoor)—For well-known excellence of quality.

Holland, S., and Co.—For excellence of quality and skill in working his quarries.

Holmes, J.—For a monument of fine-grained and well-tinted variety of coal measure sandstone.

Howard, Hon. J.—For illustrative collection on a practical scale of the minerals of the Forest of Dean.

Howard, Ravenhill and Co.—For novelty in the manufacture of bridge-links.

Johnson, Matthey, and Co.—For excellence in the manufacture of platinum, and for a splendid and instructive collection of rare metals of practical value and scientific interest.

Lilleshall Iron Company—For cold-blast coke pig-iron worked in a charcoal hearth, of sufficiently good quality to make fine wire.

Lizard Serpentine Company—For a full exhibition of Lizard serpentine, and its adaptation to various purposes, particularly a monolith obelisk and a font.

Llangollen Slab and Slate Company—For the extraction of the largest slab in the Exhibition, from quarries in the Upper Silurian formation.

Londonderry, Marchioness of—For instructive model showing the arrangements of a coal-shipping harbour, and for samples of an important building stone.

Lowry, J. W.—For fidelity, coupled with excellence of execution in his engraving of fossils on steel.

Macdonald, A.—For the labours of his father and himself in opening out new quarries of granite in Aberdeenshire, and for the fine-polished specimens exhibited.

Margam Tin Plate Company—For very high quality of tin plates.

Meik, T.—For a well-executed model of a very complete drop for shipping coal.

Mersey Steel Iron Company—For heavy forgings and taper-rolled iron, especially for the crank-shaft and armour-plate.

Michell, R.—For a model and specimens illustrative of tin smelting.

Mona Mine Company—For copper of excellent quality, and for the specimens illustrating the processes of cementation and copper smelting.

Monk Bridge Iron Company—For iron of excellent quality.

More, Rev. T. F.—For a model of the lead mining district in the Lower Silurian rocks south-west of Stiperstones, Shropshire.

Museum of Practical Geology—For instructiveness of model constructed by T. B. Jordan, comprehensively showing the workings in mineral veins.

Mylne, R.—For instructive map of the formations which bear on the question of water-supply of the basins of Paris and London.

Newcastle, Duke of—For perseverance in opening out a new coal district under very difficult conditions.

Parkside Mining Company—For sections of the mines, beautiful specimens of hematite ores, and iron made from them.

Patent Plumbago Crucible Company—For black-lead and fire-clay crucibles of good quality.

Pearce, W., jun.—For his column and other specimens of serpentine, worked entirely by himself.

Pease, J. and H.—For accurate illustrations of the method employed for lowering to the main line of rail large quantities of ironstone.

Price, Dr. D. S.—For an instructive collection illustrating the manufacture of iron.

Quilliam, T.—For examples of the little-known building stones and marbles of the Isle of Man.

Rhiwbryfdir Slate Company—For general excellence of quality and examples of remarkably perfect cleavage.

Robinson, W., and Co.—For a collection of tin-plate and galvanised sheet-iron of excellent quality.

Rogers, Ebr.—For his active share in developing, since 1851, the iron ores of the Brendon Hills and Exmoor, and the hematite ore of Cwm Noddi.

Salt—Chamber or Commerce—For good illustration of an industry conducted on an enormous scale.

Schneider and Hannay—For models and specimens illustrating the very large make of iron per furnace.

Scottish Ironmasters—For a comprehensive collection of the iron ores and coal, and pig-iron of Scotland.

Shelton Bar Iron Company—For collection of iron, smelting products, and iron of good quality, and especially for the manufacture of a large plate.

Sim, W.—For producing a fine obelisk of a silver grey granite from a new locality.

Smith, R., for Earl Dudley—For a fine collection of iron of good quality.

Sunderland Local Committee—For elaborate model of a harbour and railways adapted for shipping large quantities of coal.

Swansea Local Committee—For an instructive collection illustrating the metallurgical products of their districts.

Taylor Brothers and Co.—For excellence in the manufacture of wrought-iron.

Thompson, Hatton, and Co.—For tin-plate of excellent quality.

Vint, G., and Brothers—For their obelisk of a new and beautiful variety of coal-measure sandstone.

Turner, Cassons, and Co.—For excellence of quality in their produce.

Vigra and Clogau Copper Mining Company—For the first successful result in Britain, chiefly due to their agent, John Parry, of the working of a gold bearing-vein.

Weardale Iron Company—For excellent quality of pig-iron, especially for the description known as spiegel iron.

Welsh Slate Company—For the successful extraction of slates of superior quality, and very large slabs of the Lower Silurian rocks of North Wales.

Wimshurst's Patent Metal Foil Company—For the sheet of cut lead exhibited.

Wood and Daglish—For showing the important application of a fixed underground engine to traction in horizontal, in dip, and in rise workings.

. Woodhouse and Jeffcock—For instructiveness of model showing the long-wall mode of working as practised at Shipley.

Wombwell Main Coal Company—For specimens of coal and of the newly-discovered Lincolnshire iron ore, the latter arranged so as to represent the natural strata.

Wright, S.—For the good quality of green slate from the environs of Borrodale.

Ystalyfera Iron Company—For economy of production of anthracite iron and tin-plate, illustrated by a good collection of products.

CANADA; Billings, E., of the Geological Survey—For his published decades on Canadian fossils, and his valuable general contributions to palæontology.

English and Canadian Mining Company—For the skill and perseverance with which they have opened their ground, and the discovery of deposits conformable with the stratification.

Foley and Co. —For plans of mines, ores, and lead, smelted in the colony.

Hunt, J. Sterry, of Geological Survey—For the instructively-described series of the crystalline rocks of Canada, and his various published contributions to geological chemistry.

Larue and Co.—For excellent cast iron railway-wheels, made from bog iron ore, which have run 150,000 miles.

Montreal Mining Company—For interesting series of copper ores, accompanied by plans and sections of the workings.

Taylor, A.—For good specimens of crude and prepared gypsum, with plans and section of the gypsum mines.

The Officers of the Geological Survey of Canada—For an admirably prepared collection of specimens illustrating the mineral rosources of the province.

Walton, B.—For the discovery of good roofing slates.

West Canada Mining Company—For specimens and plans illustrating a well worked copper mine.

Williams, for Canadian Oil Company—For introducing an important industry by sinking artesian wells in the Devonian strata for petroleum.

COLUMBIA: Executive Committee—For their valuable collection illustrating the mineral wealth of the colony.

INDIA: Dr. Hunter—For a carefully collected series of pottery clays and their manufactured products.

East India Iron Company—For an interesting and instructive collection of specimens illustrating the production of iron and steel in Madras.

Local Committee, Calcutta—For interesting collection of works executed in soapstone.

Montgomery, Martin—For his illustration of the hydrographical basins of India.

Oldham, Professor—For specimens, with the analyses, of a series of coals from many localities in India, and for the elaborate work of the Geological Survey conducted by him.

Rajah of Vizianagarum—For the interest attaching to his graphite, found in a new locality. For an extensive collection of soils and the scientific labour bestowed on the analysis.

Surveyor-General of India—For the admirably executed maps of a part of the Himalaya, by the Topographical Survey now in progress.

JAMACIA: Lucas, Barrett—For geological maps and sections, by himself and Mr. Sawkins, with specimens of rocks and ores.

NATAL: Sutherland, Dr.—For his new topographical map of the colony.

NEW BRUNSWICK: Commissioners of New Brunswick —For general collection of rocks and minerals of the colony.

NEWFOUNDLAND: Newfoundland Government—For a general collection of rocks and minerals of the island.

NEW SOUTH WALES: Australian Agricultural Company—For fine specimens of good coal, representing their workings on an extensive scale.

Dawson, A.—For a collection illustrating the various building stones of the colony.

Keene, W.—For his persevering labour in making the collection of the coal, rocks, and fossils of several localities, illustrated by a map and section.

Low, J. C.—For his excellent model explanatory of the processes of working stream gold.

MacLean (Surveyor-General)—For his new map of the colony, and the outlines thereon of its general gold fields.

Royal Mint—For admirably arranged and instructive series of samples of gold and of the beds passed through in the sinkings.

NEW ZEALAND: Bank of New Zealand—For valuable series of the varieties of gold from the Otago fields.

Heapy, C.—For his collections and geological map of Auckland, and his drawings of volcanic rocks and hot springs.

NELSON: Nelson Government—For their collection and the production of the geological map, by Mr. Hochstetter.

OTAGO: Holmes, M.—Interesting collection of gold specimens and views of local scenery.

NOVA SCOTIA: Honeyman, Rev.—For a large collection of specimens illustrating the geology of the colony.

Howe, Professor—For collection arranged by him, illustrative of the rocks and minerals of the province.

Provincial Government—For their large and instructive collection, illustrating the occurrence of gold.

Scott, J.—For column of coal, showing the entire height of the seam, 34 ft.; one of the thickest known beds in the world.

SOUTH AUSTRALIA: Burra Burra Mining Company—For fine instructive series of their copper ores.

Kapunda Copper Mining Company—For an instructive collection of copper ores, smelting products, and copper.

Wallaroo Mining Company—For specimens of copper ore representing a new and important district.

Wheal Ellen Mining Company—For fine specimens of lead ores and lead smelted in the colony.

TASMANIA—Calder, J. E.—For an instructive series of rocks, building stones, and fossils of the colony.

Commissioners of Tasmania—For series of specimens, especially for those of coal and marble.

Gould, C.—For collections, and his arduous labours in developing the the geological structure of Tasmania.

Milligan, J.—For his collections, and his merit as a geological pioneer in Tasmania.

TRINIDAD—Wall, G. P.—For the geological map and descriptions of Trinidad, executed by himself and Mr. Sawkins.

VICTORIA—Bank of Australia—For extensive and interesting series of specimens of gold.

Bank of New South Wales—For fine specimens of gold in matrix.

Blackhill Mining Company—For quartzose stuff of low produce, skilfully and successfully worked.

Burkitt, A. H.—For his neat and instructive analysis of auriferous drift.

Clark and Sons—For well-selected and fine specimens illustrating the produce of a well-worked mine.

Clunes Mining Company—For auriferous vein stuff, illustrating the produce of their extensive workings.

Colonial Bank of Australia—For exhibition of different varieties of gold, chiefly in drift.

Commissioners of Victoria Exhibition—For the well-mounted stamps sent by them to illustrate the extraction of gold by stamping and amalgamation.

Daintree, R.—For photographs of rocks, fossils, and scenery illustrative of Victorian geology.

Davidson, R.—For detailed survey on a very large scale of one of the richest gold fields of the colony.

Knight, J. G.—For the pyramid instructively representing the total quantity of gold raised in Victoria, and for the specimens of the building stones of the colony, illustrated by a treatise.

McCoy, Professor Frederick—for collection of fossils illustrating the order of the sedimentary rocks, and for good engraved plates of fossils.

Rowe, G.—For faithful and beautiful delineation of the country, workings, and other relations of the gold fields.

Smyth, Brough—For the topographical delineation of various mining districts, with the lines of the gold-bearing veins and runs.

Selwyn, A.—For the progress of his survey, alike important to the colony and to all geologists.

Turner, W. J.—For an extensive exhibition of precious stones of the colony, gold, tin, and other minerals.

Victoria Government—For the well-arranged gold statistics of the colony and their valuable exhibition of gold specimens.

Victoria Kaolin Company—For enterprise in the discovery and development of the first kaolin found in the colony.

HONOURABLE MENTION.

Aaron, E. and W.—For exhibition and analysis of an extensively-used limestone.

Aberdare Steam Fuel Company—For their good manufacture of agglomerated coal.

Aytoun, R.—For simplicity and effective working of his apparatus for securing safety in case of breaking of rope.

Barker, R.—For a good collection of hematite ores.

Barrow, B.—For a case of raw materials from the Isle of Wight, and of the products manufactured from them.

Bennets, W.—For an application of a safety-clutch to inclined shafts, which has worked well in practice in Cornwall.

Bessemer, H.—For the invention and practical application of a process of the highest importance for the direct conversion of pig-iron into malleable iron and steel.

Brunton, J. D.—For ingenuity of his apparatus for cleansing and moulding peat.

Brunton, W. and Co.—For good quality of his safety fuse.

Caithness, Earl of—For patented method of cutting and preparing Caithness flagstones.

Callow, J. J.—For ingenious safety apparatus, so contrived as not to be brought into play by mere slacking of the rope.

Campbell, Bros.—For foundry iron of good quality.

Case and Morris—For complete series of specimens of the strata sunk through at their pits, and arranged in natural order.

Cochrane and Co.—For a difficult casting 12 ft. by 3ft. by ¾-in.

Copeland, G. A.—For the utility and convenience of his cartridges for blasting in wet ground.

Corbett, J.—For specimens of varieties of salt produced from brine-springs.

Corbett, W. F.—For the model of an apparatus to prevent overwinding, devised and put up by John Davies, at Lightmoor Colliery.

Crown Preserved Coal Company—For good manufacture from the best materials.

Duncan, Falconer, and Whitton—For large slab and step from the lower old red sandstone of Arbroath.

Ellam, Jones, and Co.—For specimens of emery illustrating its mode of preparation.

Ellis and Everard—For specimens illustrating the application of the syenites of Bardon Hill.

Finnie, A., and Sons—For good specimens, accompanied by section and analysis, of the different seams.

Firth, Barber, and Co.—For specimens showing the full thickness of the Barnsley seam of coal.

Fryar, M.—For drawings exhibiting useful arrangements in collieries.

Gardner, R.—For collection of the white building stone, of the new red sandstone, and the associated copper ores and barytes.

General Mining Company for Ireland—Large specimens of calamine, illustrating a new and important discovery.

Halifax Corporation—For their collection and the exhibition of the peculiar marine fossils characteristic of the lower series of coal.

Hampshire. J. K.—For the model of a safety apparatus proposed by him.

Harrison, Ainslie, and Co.—For the only production of charcoal iron in England.

Heaven, W. H.—For interesting specimens showing the character of the granite of Lundy Island.

Hill, Frederick—A collection of the mineral products of the district.

Hunt, J.—For a modification in the jigging process, tending to introduce continous action.

Jenkins, W. H. and Co.—For utilising the waste products of Cornish mines and obtaining ochre and umber therefrom.

Jordan, J. B.—For a set of models, suitable for instruction in schools.

Jordan, T. B.—For his excellent workmanship in constructing the model of the Holmbush Mine.

Jordan, W. H.—For a neat and strong form of pit-frame, and simple application of safety apparatus.

Juleff, J.—For assay crucibles of excellent quality.

Kinsman, Rev. R. B.—For exhibition of the durable Devonian slate of the old quarries of Tintagel.

Knowles, A.—For a model of Owen's safety-cage, which from its simplicity is applied in numerous collieries in Lancashire.

Leeswood Green Colliery Company—For specimens of a newly-discovered seam of Cannel, very remarkable for its high yield of gas.

Leiss, F.—For application of mica by lettering and other purposes.

Lever, Ellis—For convenience and efficiency, especially in cases of emergency.

Levick and Simpson—For good pig and wrought iron.

Livingstone, A. S.—For good manufacture of patent fuel from several varieties of coal.

Lund Hill Coal Company—For exhibiting in full height the Barnsley bed of coal, 9 ft. high.

Micklethwait, R.—For large examples of extensively used grinding-stones.

Mitchell, W. B.—For collection illustrating the mineral products of Derbyshire and South Yorkshire, and their applications.

Murray, A.—For sections and specimens of the beds of anthracite in Pembrokeshire.

Murray, J.—For model of compound steam-engine, with four drums, especially adapted for underground traction.

Nixon, Taylor, and Cory—For interesting specimens of coal and good illustrative section.

Nowell and Robson—For fine and large landing from coal measure flags.

Packard and Co.—For collection showing the character of the coprolites, and other phosphatic masses, and manures produced from them.

Palmer, C. M.—For noted good quality of coke made from Marley Hill coal.

Parkend Coal Company.—For fine block of coal raised from pits which have been foremost in introducing improvements.

Parkinson—For Upward's manufacture of coke from anthracite smalls and dust.

Paull, J. M.—For ingenious attempt to avoid the use of springs in the construction of a safety-cage.

Pirnie Coal Company—For a peculiar variety of Cannel, specially adapted for the production of gas and oils.

Purified Fuel Company—For peculiar method of manufacturing patent fuel from washed small coal.

Queensgate, Whiting, and Co.—For specimens illustrating the manufacture of Paris white, of superior quality.

Ramsay, G. H., and Sons—For exhibition of good coke and Cannel, a rare production of the Northumbrian coal field.

Ray, J.—For a complete illustration of a part of the coal field which is fully developed only in a limited district.

Raynes, Lupton, and Co.—For aiding in the development of an important branch of industry.

Redruth Local Committee—A collection of mineral productions of district.

Reid, P. S.—For successful employent of tools devised by him for the extraction of damaged tubing from above a bore hole near Yarm.

Rhosydd Slate Company—For a light and smooth quality of their slate.

Rosedale Iron Ore Company—For gigantic specimen of a very remarkable iron ore of recent discovery.

Ross of Mull Granite Company.—For having opened out the fine red granite of that island.

Seccombe, J.—For fine specimens of oxide of copper.

Sweetland, Tuttle, and Co.—For a series of specimens illustrating copper smelting.

Tavistock Committee - For the collection of the mineral products of their district.

Townshend, Wood, and Co.—For specimens of tin plate and iron.

Trotter, Thomas, and Co.—For well-worked examples of the excellent coal-measure sandstones of Dean Forrest.

Waring, C. H.—For his method of ensuring the extinction of the light when the gauze is unscrewed from a safety-lamp.

Watson, H.—For a convenient form of pump worked by the rope of the underground traction apparatus.

Weston and Price—For manufacture of good railway materials.

Wright, J., and Son—For a superior polished granite vase.

Yniscedwyn Iron Company—For interesting specimens illustrative of the anthracite district of South Wales.

CANADA: Davies, W. H. A.—For interesting and instructive specimens from a remarkable deposit.

McCaw, T.—For fine and instructive specimens of ores, running with the stratification, and illustrating the structure of the country.

Sweet, S., and Co.—For fine and instructive specimens of ores, running with the stratification, and illustrating the structure of the country.

INDIA: Government of India—For complete and instructive series illustrating the dressing and smelting of tin ores from a new locality.

Guthrie, Col.—For the exhibition of his very beautiful series of works of art in jade and rock crystal.

Mitchell, Captain J.—For an instructive series of specimens of magnetic iron-sand employed in some parts of India by native iron smelters.

New South Wales: Lady Cooper—For exhibition of interesting series of gold specimens of the colony.

Patten, W.—For collection of polished marbles from Argyle.

Samuel, S.—For his zeal in sending specimens of copper ore and copper.

New Zealand: Cadman, J.—For an interesting series of the rocks of the colony.

South Australia: Cornwall Mining Company—For very large specimens of gossany copper ore.

Great Northern Mining Company—For a fine specimen of nearly pure red oxide of copper.

Mount Rose Mining Company—For fine specimens of copper ore.

Priest, T.—For exhibiting slabs of slate from the quarries of Montara.

Rodda, R. Y.—For novel experiments in the treatment of copper ores.

Worthing Mining Company—For a collection of copper ores and smelting products.

Victoria: Abel, Prof. J.—For the exhibition of a mass of meteoric iron of great size.

Baillie and Butters—For fine specimens of auriferous vein, and of various minerals.

Beechworth Local Committee—For illustrative set of specimens.

Bendigo Mining Company—For their instructive section.

Benyen, J.—For his rich specimens of auriferous vein-stone.

Camp Company—For zeal displayed in exhibiting samples from their deep sinkings.

Catherine Reef Mining Company—For zeal in sending a large quantity of auriferous vein stone.

Foord, G.—For the interest of his collections.

Gething, G.—For the care bestowed in forwarding interesting crystallized specimens.

Great Republic Gold Mining Company—For zeal displayed in exhibiting samples from their deep sinkings.

Joske, Paul—For rich specimens of gold in the matrix.

Nelson Gold Mining Company—For zeal displayed in exhibiting samples from their deep sinkings.

Prince of Wales Gold Mining Company—For zeal displayed in exhibiting samples from their deep sinkings.

Royal Saxon Gold Mining Company—For zeal displayed in exhibiting samples from their deep sinkings.

Vignoles, C.—For the striking delineation on a large scale of the forms of the cretaceous and tertiary rocks in the Cantabrian chain.

Whitelaw, J.—For well-constructed model of his apparatus for safety in case of the rope breaking.

Western Australia: Shenton, A.—For a collection of fossils showing the existence of secondary age in Western Australia.

Notes on the Auriferous Mines and Deposits of the Spanish and Portuguese Estremaduras.

By H. W. Bristow, F.R.S., F.G.S.,
(Of the Geological Survey of Great Britain.)

The immense richness in gold of the two Estremaduras of Spain and Portugal has been known from the remotest antiquity: it is mentioned particularly in sacred history (1 Mac. viii, v. 3), and it has been equally celebrated by profane writers.

Let us specify some instances; and, passing over in silence the great quantities of gold and silver which were extracted in those countries by the Phoceans, the Phœnicians, and the Carthaginians, begin with the Romans. We learn that more than five hundred governors, prior to the first Cæsars, without reckoning special generals, proconsuls, quæstors, tribunes, and a host of other civil and military chiefs, all equally greedy and insatiable of gold, returned to Rome laden with enormous wealth.

Herodotus, who lived B.C. 450 years; Varro, who lived three and a-half ages later (b. iv, c. 152); Strabo (b. iii, c. 1), contemporary with Tiberius and Claudius; Caius, the historian, Diodorus of Sicily (c. xxxix, &c.), as well as Pliny the younger, who lived under Vespasian, Domitian and Trajan; have handed down to us accounts of the auriferous workings carried on during the Roman domination,—the last named especially, relating with admiration and enthusaism, the methods in use by the miners of that period (b. xxiii, c. 30).

Other ancient authors speak with equal admiration of the great richness of the gold and silver mines of Spain, and enter into curious details in reference to the nature of those undertakings in Estremadura (then called Lusitania).

Lentulus (B.C. 197) carried off 20,000lbs. of silver in ingots, 34,500lbs. in coin, and 1,515lbs. of gold.

Marcus Portius Cato, who went to the Iberian Peninsula about 195 B.C., carried on this kind of enterprise with the greatest activity and with a continually increasing ardour. He obtained from it, in one year only, 25,000lbs. of silver in ingots, 123,000lbs. in coined money, 540lbs. of silver *osceme*, and 1,400lbs. of gold.

Quintus Fulvius Flaccus, fifteen years later, also got 124 crowns of gold, 31lbs. of gold in ingots, and 178,000lbs. of coined gold (cap. 43, b. 40). The sums carried away by Fulvius were so great that he himself paid his soldiers, and that profusely, until his return to Rome, where he gave grand games and entertainments for ten successive days, and erected at his own expense the magnificent temple of Equestrian Fortune in discharge of a vow he had made in Spain.

Licinius Crassus, the celebrated proconsul of the Iberian Peninsula (B.C. 94), surpassed his predecessors and amassed such a colossal fortune that after having thrown away gold profusely in incessant and extravagant prodigalities, he left besides at his death 134,000,000 of *reals*, the result of his labours and depredations in Spain.

Julius Cæsar, during the periods of his four governments, amassed more than fabulous wealth.

About 40 years B.C., Dionysius Calvinus had accumulated such enormous sums that, although the number of senators was very great, he feasted each of them individually with magnificent banquets, and obtained the honours of a triumph by means of presents of great value.

The preceding summary, relating to a small part of the riches produced by the mines worked by the ancients, without including in it the sums which each Roman privately possessed, and which he avoided making known in order to escape offering them to the senate, can afford only a faint idea of the enormous treasures yielded by Spain, and which were absorbed in the embellishment and augmentation of the power of Rome and her rival Carthage, to which Spain was then what, at a more recent period, the Americans were for the latter.

That similar immense riches were reproduced during the rule of the Arabs is proved by the concurrent evidence of tradition and of the numerous excavations still in existence; but, now, fallen in by time, or filled up by the order of Phillip I (1506-1510).

At a later period, after the conquest of Grenada, the *gremio de los artilleseros* (a corporation which dates from the Arabs, and was privileged and endowed with feudal rights) instituted numerous searches for gold on the banks of the Tagus and the Salor; and, according to documents still extant at Alcantara, where this corporation had its seat, as well as from the accounts of the Secretary of the Grand Master of the Order, it appears that for several years the average quantity of gold daily procured by each *artillesero* amounted to 80 grains, inclusive of 20 grains reserved for profit and the wages of the workmen. It was in consequence of the great advantages accruing from the Arab company of *artilleseros* that their families were protected from the persecutions of the Jews (1492 and afterwards); until, in 1610, they, in common with the entire Moorish race, were finally expelled the country.

In the face of such important facts, it may naturally be asked how the abandonment, from so remote a period, of mines yielding such fabulous wealth can be explained.

The history of Spain, since the Roman period to our own times, will furnish the key to this anomaly.

Besides the continual wars which for so many years devastated the Peninsula, the following causes have tended to produce the present neglect of these mines:—1st. The depopulation of the Spanish Peninsula, reducing the number of inhabitants to 5,000,000, which, according to Viardo, had amounted to 40,000,000, and even to 60,000,000 or 70,000,000 according to Osorio. 2nd. The discovery of America, whose importations of gold and silver were continually arriving, paralyzing the operations of the mines at home, which were moreover prohibited. 3rd. The restrictive ordonnances of the absolutism which prevailed in Spain and Portugal.

Such are the chief causes which have successively contributed to bring about this prolonged decadence.

Certain rare exceptions, in the shape of particular concessions granted to a few privileged persons, caused a momentary reappear-

ance of the auriferous treasures of the Spanish and Portuguese Estremaduras.

The German Talaquer, in 1792, began a working in the mountains of Jola, whence he extracted gold in such quantities that he made a present to Charles IV of seven large ingots of gold, the produce of the mines in question.

Alonso Beltran, a Spaniard, born in the country in question, also worked at the same period and with great success, near the banks of the Tagus and the Salor, the gold mines of *Dehesa de la Claveria* and its neighbourhood, situated near Membrio, from which he procured the magnificent nugget, as large as two fists, which he offered to the King and which was long the admiration of all the visitors to the Cabinet of Natural History at Madrid. In these latter mines there was a vein of earth from which gold was extracted, all in grains the size of barley-corns (Revista Minera, p. 360).

The fortunate adventurers did not profit long by their discoveries. Talaquer escaped the Inquisition by a miracle; Beltran continued working furtively and by night, but, denounced anew, he also was compelled to abandon his labours and to content himself with writing an account of the mines. The truthfulness of this record, the M.S. of which is still in existence, has been fully confirmed by subsequent discoveries.

Circumstances have changed since that period, and the Governments in question, so far from prohibiting mining enterprises, on the contrary encourage them. This change of policy has caused the discovery of a great many new localities; but the wrong direction which, until now, has been given to most mining undertakings, combined with the great abundance of these fresh localities to which the amounts of capital subscribed has been in no degree commensurate —capitalists being generally mistrustful and timorous where great enterprises are concerned—has caused the riches stored up in these localities, whence antiquity derived them in such fabulous quantities, to be forgotten.

In 1828-29-30, Mons. Joseph de Viri, following the indications left by Beltran, recommenced the working of a vein of auriferous quartz near Membrio, from which he extracted, in a short time and by very unfavourable processes, a large quantity of the purest gold; but the departure of this gentleman, consequent on the civil war which for seven years convulsed Spain, put an end to the enterprise which seems to have given fair promise of being attended with success.

In 1850, the discovery was made of a fresh reef (*gisement*) of auriferous quartz, 33 centimetres wide, presenting gold to the eye in very notable quantity.

About the same time, 1851, the talented Engineer Mons. Amelio Maestre wrote in reference to the auriferous localities in question:—"These indications are sufficient, I imagine, to direct attention to these localities which are probably destined to become a new California in the Iberian Peninsula, without stopping now to speak of the richness in gold of the neighbouring kingdom of Portugal, nor of the auriferous deposits forming the banks of the Tagus, the Alajon, the Salor, and other rivers which traverse this country (Revista Minera, No. 12, p. 361). At a later date (in 1854) the

learned French Engineer Mons. Clement Roswag, in a work of remarkable precision, gives the history of the ancient workings for gold which, executed on a colossal scale, and commencing in the Mountains of the Sierra de Gata, adjoin the localities under notice. The greater number of the gold mines which he mentions are at a slight distance from each other, and on the left bank of the Tagus; a river which, in every age, has been celebrated for the gold which it bears. On the right bank of the same river are situated the mines and auriferous deposits of Portugal, noted, for many ages, for the large quantities of the purest gold which are daily found on the surface of the ground.

It is, therefore, beyond a doubt that of all the metalliferous regions of the Iberian Peninsula, the most worthy of attention for its auriferous richness is that now under notice; which, starting from the neighbourhood of the River Cicere in Portugal, runs in a north-easterly direction, forming a zone of 4 or 5 leagues of breadth, and gradually loses itself in the neighbourhood of Plasencia in Spain. It then reappears towards the mountains of Toledo, crossing diagonally the boundary of the two kingdoms, and is apparently of the same geological age.

(To be continued).

Abstracts and Reviews.

THE *BERG- UND HUETTENMANNISCHE ZEITUNG.*

Berg- und Hüttenmännische Zeitung. Mit besonderer Berücksichtigung der Mineralogie und Geologie. Redaction: K. R. Bornemann, Kunstmeister in Freiberg und Bruno Kerl, Bergamtsassesor in Clausthal. *Freiberg*: *J. G. Engelhardt.*

The *Berg- und Hüttenmännische Zeitung*—which, as most of our readers probably know, is a weekly Journal, devoted to Mining and Metallurgy, published at Freiberg—has now entered upon its 21st year. The high character of this periodical, which contains contributions by most of the leading Miners and Metallurgists of Germany, has been long established; and under the present Editors this reputation has been fully maintained. The following are the contents of the first 20 numbers of the present year, from January 1st to May 14th.

No. I. *Jan.* 1.—On the Extension of Sulphur Mining at Swoszowice, in the southern vicinity of Cracow, by Dr. Carl Zerrenner.—The iron-foundries of Berlin, by E. F. Dürre.—On the Rock-boring Machines of Schumann, Sommelier, and Schwartzkopff (with plate).—Proceedings of the Miners' Association of Freiberg.

No. II. *Jan.* 8.—On the Extension of Sulphur Mining at Swoszowice (conclusion) by Dr. Carl Zerrenner.—On the Rock-boring Machines of Schuman, Sommelier, and Schwartzkopff (continued).—Notices.—Reviews.

No. III. *Jan.* 15.—The Iron-foundries of Berlin, by E. F. Dürre (continued).—On Copper Cementation in Norway.—Researches on the heat of fused iron: abstract of paper by M. M. Minary and Résal, in the *Annals des Mines*, Vol. XIX.—Reviews.—Notices.

No. IV. *Jan.* 22.—On the intermitting hot springs of Neuenahr, in the Rhine-province, by Dr. Jacob Nöggerath.—The Iron-foundries of Berlin, by E. F. Dürre (concluded).—On the Rock-boring Machines of Schumann, Sommelier, and Schwartzkopff (concluded).—Abstracts.—Notices.

No. V. *Jan.* 29.—On the causes of the preservation from decay of wood impregnated with sulphate of copper. by C. Weltz, Norway.—On the the present conditions of the Iron-industry of England: abstract from paper by M. M. Gruner and Lan, in the *Annales des Mines.*—Production of the Royal Hanovarian Iron-works in the year 1860-61.—On a form of Auxiliary Steam-engine used in the Newcastle Coal-field.—Portable engine used in the *Haute Vienne.*—Water-pressure-engine at Saint Nicholas (*Meurthe*): abstracted from the *Annales des Mines.*—Abstracts.

No. VI. *Feb.* 5.—Hot air apparatus for utilising the gases of Blast Furnaces, by W. Bussius (with plate) —The Royalties on Metallic Mines, by M. Grell.—On Lead Mining in the South of Spain, by M. Petitgand: abstract from the *Revue Universelle.*—Abstracts.

No. VII. *Feb.* 12.—A comparison of certain modes of dialling, by Dr. August Junge.—On the present condition of the Iron-industry of England: continued abstract of M.M. Gruner and Lan's papers.—On Lead Mining in the South of Spain, by M. Petitgand (conclusion of abstract from *Revue Universelle*).

No. VIII. *Feb.* 19.—The new Silberblick Mine in the Upper Harz, by C. Saacke.—Studies on Bessemer's Process, by M. A. La Salle.—The Belgian treatment of Zinc.—Proceedings of the Miners' Association of Freiberg.—Reviews.—Notices.

No. IX. *Feb.* 26.—The mixture of ores used in the Lerbocher Iron-works, in the Harz, by Friedrich Hahn.—Statistics of the Royal Mines of Saxony, in the year 1860.—Studies on Bessemer's Process, by M. A. La Salle (concluded).—On the roasting of Iron ores, by Herr Haardt.—The working of Tin and China-clay at Carclaze Mine, near St. Austell, Cornwall.—Reviews.—Correspondence.

No. X. *March* 5.—On certain forms of Blast-furnaces for utilising the waste gases, by W. Bussius (with plates).—On the determination of Sulphur in Iron and Iron-ores, by V. Eggertz and F. M. Stapff (with plate).—Thermometer for showing the temperature of the hot air in Blast-furnaces, by W. Bussius (with plate).—Reviews.

No. XI. *March* 12.—The occurrence of Nitrogen and Organic substances in the Earth's crust, by M. Delesse: abstract from the *Annales des Mines.*—On the determination of Sulphur in Iron and Iron-ores, by V. Eggertz and F. M. Stapff (concluded).—Proceedings of the Miners' Association of Freiberg.—Abstracts.

No. XII. *March* 19.—On the application of Electro-magnetism in the mechanical preparation of copper ore, in Traversella, in Piedmont, by Gaetan Burci (with plate).—Production of the Mines and Smelting Works of the district of the Lower Harz, for 1860-61.—Bunsen on the formation of Granite.—Reviews.—Notices.

No. XIII. *March* 26.—An improved form of Blow-pipe, with moveable nozzles, by Osius and Osterland.—The occurrence of Nitrogen and Organic substances in the Earth's crust, by M. Delesse: continuation of abstract from *Annales des Mines.*—Fire-proof English quartz bricks and clays.—On the applications of Pyrites in the department *du Gard*, by de Ricqlès.—Copper Smelting process in India and Japan: from Dr. Percy's *Metallurgy.*—Notices.—Review of New Mining Literature.

No. XIV. *April* 2.—Geognostical sketch of the *Kaisergrube* in the district of Offlitz, Bezirk Lack, Carniola, by Dr. F. N. Stapff (with plate).—On the application of Electro-magnetism in the mechanical preparation of Copper ore, by G. Burci (concluded).—Abstracts.

No. XV. *April* 9.—Sulphuretted Hydrogen as precipitating medium in the treatment of poor Copper pyrites, by Carl Weltz (with plate).—On the Ore-formation of Kleinkogl, by Dr. F. M. Stapff (with plate).—Correspondence.—Reviews.—Notices.

No. XVI. *April* 16.—Description of an underground Survey, by Dr.

August Junge (with plate).—Travelling Notices of England: Tin Mining in Cornwall.—Notices.

No. XVII. *April* 23.—Description of an underground Survey, by Dr. August Junge (concluded).—The occurrence of Nitrogen and Organic substances in the Earth's crust, by M. Delesse: continuation of abstracts from *Annales des Mines*.—Reviews.

No. XVIII. *April* 30.—On the production of Gold, Copper, and Iron, at the Imperial Mining and Smelting Works of the Ural Mountains in the year 1859, by H. Von Jossa.—On the addition of lime to water used in boring holes in Mines, by C. Saacke.—The occurrence of Nitrogen and Organic substances in the Earth's crust, by M. Delesse: continuation of abstract from *Annales des Mines*.—Abstracts.

No. XIX. *May* 7.—Notice on the making of Iron at the Royal Furnaces of Oberschlesien, compiled by C. M.—On the present condition of the Iron-industry of England, by MM. Gruner and Lan; continuation of abstract from *Annales des Mines*.—Proceedings of the Miners' Association of Freiberg (continued).—Notices.

No. XX. *May* 14.—Extraction of poor argentiferous and non-argentiferous Copper Ores at the Smelting Works of the Starkenbacher Mining and Smelting Establishment at Rochlitz, by Hüttenmeister H. Meyer.—Reviews.—Abstracts.

THE ROYAL SOCIETY.

Proceedings of the Royal Society. Vol. XII., Nos. 49, 50. London: Taylor and Francis, Red Lion Court, Fleet Street.

These numbers of the Proceedings of the Royal Society contain abstracts of Papers "On the Law of Expansion of Superheated Steam," by Mr. William Fairbairn, LL.D., F.R.S., and Mr. Tate; and "On the Rigidity of the Earth," by Prof. William Thomson, F.R.S., which may be of interest to our readers.

In Messrs. Fairbairn and Tate's Paper, referring to a former communication selected for the Bakerian lecture, entitled "Experimental Researches to determine the Density of Steam at different Temperatures, and to ascertain the Law of Expansion of Superheated Steam," where it was shown that although Dumas, Gay-Lussac, and other distinguished physicists had determined the density of steam at 212°, it was left for those researches to ascertain the law of density, volume, &c., at all temperatures, and also the law of expansion of superheated steam. The authors go on to state that the experiments having been continued, had elicited remarkable results as regards the rate of expansion at various temperatures.

After noticing the former experiments of Mr. Frost and Mr. Siemens, and pointing out some defects in the method of conducting these experiments, the authors proceed to describe the apparatus used by them, and the results arrived at. The general conclusions demonstrated by these extended series of experiments are the same as those suggested by the authors in their previous paper—that the rate of expansion of superheated steam is almost identical with that of air and other permanent gases, if calculated at temperatures not too close to the maximum temperature of asturation.

Professor Thomson's Paper, "On the Rigidity of the Earth" is important as proving how untenable is the hypothesis, held by so many geologists, that the earth is a mass of melted matter enclosed in a solid shell of only from 30 to 100 miles in thickness. The author shows that the interior of the earth must, on the whole, be much more rigid than steel, otherwise it must yield under the tide-generating influence of sun and moon to such

an extent as to very sensibly diminish the actual phenomena of the tides, and of precession and nutation. As the earth's upper crust is at least as rigid as glass, and the earth as a whole is far more rigid, it follows that the interior, far from being molten, must be many times more rigid than even the upper crust. Indeed the author believes that the hypothesis of a thinner crust than from 2,000 to 2,500 miles is inconsistent with the observed phenomena of ocean tides and of precession and nutation.

THE BOARD OF TRADE RETURNS.

The Board of Trade Returns for the month of May, and the five months ending May 31st, were issued on June 28th.

The declared value of coal, cinders, and culm exported during the month was 348,041*l.*, being an increase of 5,614*l.* as compared with the corresponding period of the preceding year.

The exports of metals are as follows:—

	Month ended May 31st.		
	1860.	1861.	1862.
	£	£	£
Pig and puddled iron	89,325	121,823	133,919
Bar, angle, rod, and bolt iron	224,688	198,059	212,087
Railway iron	350,992	321,831	329,514
Iron wire	19,748	18,438	24,359
Cast iron	85,929	56,068	62,827
Iron hoops, sheets, and boiler-plates	109,576	95,169	99,744
Wrought iron	168,433	184,119	204,587
Steel, unwrought	69,478	68,327	83,998
Copper, ditto	61,325	47,483	21,312
Wrought copper	182,962	157,413	166,406
Brass, all sorts	18,150	16,632	18,132

Correspondence.

[We need scarcely say that we cannot hold ourselves responsible for the facts or opinions of our corrrespondents; although we shall make it a point to endeavour to exclude those who are obviously inaccurate or fallacious, as far as is consistent with our wish to encourage the freest discussion.]

BLACK-BAND AND CLAY-BAND IRONSTONES.

Sir,—Commercially speaking, iron ores are composed of only two sorts—Black-band and Clay-band—the lordship or royalty on the former being about double that on the latter. As these ores vary considerably in composition, it is often difficult to determine to which class any given sample belongs. I have thought, however, that some of your correspondents may be able to throw a light upon the matter, and point out what constitutes a true Black-band. A simple definition or test, by which one could be readily distinguished from the other, would be of great practical utility.

An Assayer.

Notes, Queries, and Memoranda.

METALLIC MINES' COMMISSION.—The Right Hon. Lord Kinnaird, K.T., the Chairman of the Commission appointed to enquire into the condition of all mines in Great Britain to which the provisions of the Act 23 and 24 Vic., c. 151, do not apply, has, during the last month, been residing at Camborne, in order to make himself more completely acquainted with the great mining districts of West Cornwall. Mr. Temple, the secretary, and other members of the Commission, have also been pursuing their enquiries in Cornwall, where, it is expected, that the labours of the Commission will shortly be concluded.

When the report of the Commission is made public we believe the exaggeration of certain statements regarding the disease and rate of mortality of metallic miners will be more completely exposed than ever we ventured to anticipate, although we have already (see vol. 1, p. 204) pretty plainly expressed our opinion on the subject. It will, we understand, be satisfactorily demonstrated that the commonly stated proportion of deaths from comsumption is entirely without foundation, and could only have originate with persons possessing a mere smattering—that fatal "little knowledge"—of medical science.

On other matters, we understand, that the report of the Commission will, on the whole, be highly favourable to Cornish Mining. Some imperfections will, probably, be pointed out, but generally the result of the enquiry will show how absurd and groundless have been the statements made in some quarters. With regard to the question of man-engines *versus* skips, we anticipate the Commissioners will adopt the view we have already taken in our article in vol. 1 (p. 366), and strongly recommend the general adoption of safety-skips with wire ropes, where man-engines are not practicable.

From Cornwall the Commissioners will, probably, proceed to the Cumberland district.

THE BREADALBANE ESTATES.—The mines, minerals, and quarries on the extensive Breadalbane Estates, in the counties of Perth and Argyll are advertised to be let. These include lead mines of Tyndrum, the granite quarries of Locheativeside, the marble quarries of Caddleton, and other mineral localities, over which extensive trials have been made. All these works have, of late years, been carried on by the Marquis, on his own account, and are understood to have resulted in a very heavy loss. From the agents selected, and the general management, this is hardly to be wondered at, and by no means tells decidedly against the properties themselves if placed under prudent and practical management.

THE CLEVELAND DISTRICT.—The production of the pig-iron in the Cleveland district during the first six months of the present year was rather over 300,000 tons. The stock of pig-iron on 30th June last, including the pig-iron in store at Middlesborough and West Hartlepool, was 33,390 tons, or upwards of 19,000 tons less than on 31st Dec., 1861.

The stocks at the following dates were:—31st Dec., 1860, 76,676 tons; 30th June, 1861, 70,053 tons; 31st Dec., 52,453 tons; 30th June, 1862, 33,390 tons,—showing a reduction in twelve months of 36,663 tons. The furnaces in blast have increased by five during that period.

THE NORTHUMBERLAND AND DURHAM MINERS' PERMANENT RELIEF FUND.—This fund is making rapid progress in the county of Durham. The agent, Mr. John Howie, appointed at last delegate meeting to visit the several collieries, for the purpose of spreading information and giving explanations on the subject, has attended many meetings, and, with one solitary exception, all have unanimously resolved to connect themselves with it and to do all in their power to ensure its success. Hetton Downs and Ellemore Collieries have agreed to join the movement, and have sent off their first list of names and subscriptions. Seaton and Seaham collieries held a joint meeting on Saturday week, the Rev. Mr. Scott, of Seaham, in

the chair: and from present appearances, these two collieries promise to conduct the movement in a most satisfactory manner, and will give a great impetus to it in that district, especially at collieries belonging to the Marchioness of Londonderry. The movement has likewise been now taken up at South Hetton, and a good society is expected there very soon. Castle Eden, too, has sent off its first list of names and subscriptions. The one exception named above was Coxhoe. A few belonging to the National Association partly succeeded in breaking up the meeting, and no vote was taken either for or against, except a vote of thanks to Mr. Howie for the fair and candid manner he had treated the question. It is, however, expected, now the National Association is dissolved—an advertisement having appeared in the papers to that effect—that all parties will see it to be their interest to join the Northumberland and Durham Permanent Relief Fund.

The following letter has been received by a pitman in this neighbourhood, after reading which, no doubt can remain that the "National Association" is completely broken up.

"Dear Sir,—I am sorry to inform you the Council have decided (for some months at least) upon closing the Association, and until they can secure the favour of the masters do not intend opening it. We are all very sorry that such a good scheme for the miners cannot be carried on.

"Yours very truly,

"HADDOCK DENNYS, Secretary."

Mining, Quarrying, and Metallurgical Review.

CORNWALL AND DEVON.

THE metallic mining districts of these counties have been marked by no particular event during the present month. The rise in the standard of copper ores, and the steadiness in the price of tin, have given more confidence as to the stability in the condition of the deep and costly western mines, whose position is so entirely dependant on the prices of metals. It is argued that if present prices can be maintained in the general stagnation of trade attending the American war and the cotton famine, we may fairly expect a considerable rise when trade and manufactures resume their normal condition.

In the mines of the two counties no very material alterations are observable. Even in Wheal Ludcott—a mine which has more completely absorbed the attention of share-jobbers then was ever known in any previous instance, no particular change has taken place. A description of this mine is given in another part of the present number, where our readers will see the nature of the discovery, which is certainly a very remarkable one. Since that was written it is stated—with what amount of authenticity we cannot say—that the rich silver bunch has been unbottomed in the winze below the 70. Whatever may be the result of this silver discovery, and of the enormous speculation founded upon it, we may say here that the mine is undoubtedly a fairly worked and respectably conducted concern, and cannot for a moment be ranked as a bubble or classed in the same category as Pelyn Wood or Silver Vein. The manager, Captain Knapp, is a man of undoubted probity and truthfulness, and the public may rely on the *facts* stated by him. Of course, the commercial value of the mine depends on the continuance of the present bunch, or the discovery of others; and this is not a matter of *fact*, but of *opinion*. The experience of the county of Cornwall is undoubtedly against the permanence of any silver deposit, and such an experience ought to have considerable weight; but, at the same time, within recent years, many things have occurred

beyond our previous experience, and consequently it is unwise to dogmatise too much upon it. We cannot pretend to limit the caprices of nature, and three years ago the profitable working of gold in Wales seemed a more ridiculous chimera than even a permanent silver mine in Cornwall. At the same time, the backers of experience in such matters have the best of it in nineteen cases out of twenty. In Ludcott a thoroughly prudent man would probably say: there is a rich bunch of silver there, which may cut out in a week, or may last long enough to realise great profits; there may be other bunches, or there may not; the whole thing is complete hazard; and those who don't wish to run tremendous risks had better avoid all connection with it. Besides the reports of the Agent, various reports have been made by other persons. Captain Charles Thomas (of Dolcoath) and Captain Thomas Trevillion (of Herodsfoot), have reported very unfavourably.

At Gurlyn, a mine situated in the parish of St. Erth, not very far from Hayle, a promising discovery has been made during the month at the 30, where the Wheal Fox lode has been intersected, 2 ft. wide, worth 3 tons of copper ore per fathom. This is a promising mine, and is under the respectable direction of Mr. Vawdry, of Hayle. In this district, in the neighbouring parish of Crowan, the working of other setts is talked of. Among them is one called Crowan Consols, a "limited" concern, the promotors of which, however, are not known in West Cornwall, and which consequently will (if it ever comes to anything) be a purely "outside" enterprise. Some way to the west of this, a sett called West Abraham is said to be about starting with a local body of adventurers. The reworking of the Abraham and Crenver Mines, in this district, which was spoken of as certain in the early part of the year, seems now definitely abandoned: a most wise determination, for sufficient money has been squandered on similar concerns to show the folly of other attempts of the kind by "London Companies."

In the Wendron district the mines look generally well, and are doing as much as can be expected with the present price of tin. Garlidna and Basset and Grylls are improved, and at Treworlis another discovery of copper is spoken of. This mine is in the killas, to the south of the Wendron Granite range, and the lode has a strong gazzan on the back, so that it is not absolutely improbable but that a permanent deposit of copper may be found. No permanent copper discovery has yet been met with in the district, and judging by our old argument—experience—many refuse to believe that it ever will be. New Wendron, west of Wendron Consols, is now at work, and is a most promising concern.

In the Camborne and Redruth districts, the mines are generally looking well. At West Tolgus, the ore in the shaft, and in the 52 end east continues very good, but the western end has fallen off. The prospects of West Tolgus making a good mine are great, and the shares are consequently in considerable demand at a great rise. For about a year advertisements of a "limited" Company to work North Pool, have from time to time appeared. The parties promoting were without influence in Cornwall, and consequently the scheme seems to have shared the fate of most similar "outside" companies. Other parties are now said to be in treaty for the sett, which is on the lands of Mr. Robartes, M.P. for the eastern division, the largest and most liberal landowner in Cornwall. North Pool ought to be worked, but with great prudence; in the hands of an "outside" company, who never can (or at least never do) get good management, a disastrous failure would probably be the result.

East Carn Brea is still opening out well, although the shares have gone back considerably. The fall, however, is due to the fact that shares were put to prices which the concern—although a most excellent young mine—never warranted. Gold may be bought too dear, and a mine may well be worth £70,000 and still not worth £120,000. But when a mine becomes

a favourite—we will assume justly so—the public rush in regardless of price, and as the supply of shares in any one mine is necessarily limited, quotations go up on the simple law of demand. The sudden advance in mining shares are due more to these causes than is usually supposed. If a railway stock, or any other public security, attract the fancy of fifty persons throughout the country, to invest a few hundreds each, such a demand is readily supplied without any very perceptible advance; but if a similar demand occurs in the case of a mine, it is so completely out of proportion to the supply that an extraordinary rise is inevitable. And thus we can account for many advances which are otherwise inexplicable. At Wheal Union, a sett adjoining East Carn Brea to the north, the workings are still promising at various points, but no discovery is yet made. At East Pool, the new lode has been cut in the 150 cross-cut north, and driven across 6 ft. without the north wall being yet seen. For this 6 ft. the lode is worth for tin and copper about £40 per fathom: copper was first met with on the south wall, but now the end is in tin: altogether the discovery at the 150 is so far satisfactory. This part of East Pool is joined immediately on the east by the western part of Wheal Agar sett, which is now idle. Considering the discovery in East Pool, this ought undoubtedly to be reworked, for the 140 end east of engine shaft in East Pool is now within 40 fathoms Agar boundary. The Wheal Agar western whim shaft could be cut down and sunk to the level of the East Pool ore ground in about 2 years, at a cost of not more than £3,000. This ought to be done, and probably must be done, for Mr. Alfred Jenkin, Mr. Robartes' Mineral Agent in this district, is not likely to allow it to remain in its present position. An engine is on the ground, although on another shaft, to which flat rods could be attached, and there is also a considerable proportion of the pitwork required on the mine.

North Crofty, adjoining East Pool, is attracting considerable attention. A description of the present position of this mine will be found in another part of our magazine. There can be little doubt that *in time* this mine will do very well, and that at present it is an excellent investment. We consider that the discovery of the granite so comparatively shallow in East Pool is of considerable importance to North Crofty, for it proves that granite is much nearer the bottom of that mine than could have been before anticipated. The highly-respectable management of North Crofty is, of course, in its favour.

In the St. Austell district, a sett called Goonbarrow and Moliness Mines, has been started under the auspices of Messrs. Watson and Cuell, Mr. Peter Clymo, of Liskeard, and Mr. William West, of St. Blazey. These names ought to be a sufficient guarantee for the excellence of the speculation.

In the St. Neot district, a new concern, called Caradon United, it started under the secretaryship of Messrs. Dunsford and Rankin, and the management of Captain Knapp, of Ludcott. This St. Neot's district has produced a great deal of ore, but never yet a permanent mine; but then it has never yet received a vigorous trial. *En passant* we may ask, if the "Caradon" district extends to St. Neot, where does it end?

The River Tamar Copper Mining Company (Limited) has been advertised. This concern—which is an old face with a new mask—is on the River Tamar, adjoining Devon Consols. All these mines to the west of Devon Consols have, as yet, been failures, although they have been under trial now for nearly twenty years. Whether any of them will yet turn out well is a matter of pure speculation. In another part of Devonshire—the Ashburton district—the Ashburton United Mines—locally known as Owlecombe—have been abandoned. This concern was started some four or five years ago by Mr. N. Ennor, with excellent prospects of success, which, however, have proved fallacious. Indeed, the experience of Devonshire mining altogether is very unsatisfactory. Indications which, in the

western district, would, in many instances at least, lead to pretty certain success, here come to nothing; a wide experience shows us that around Dartmoor indications cannot be relied on. In the neighbourhood of Owlecombe, West Beam, Sigford Consols, Smith's Wood, and the Atlas Tin Mines, are at work. On the latter Captain Charles Thomas is said to have reported highly, promising remunerative returns; and on Smith's Wood, Captain Daw, of Carn Brea, has certainly spoken very strongly. It remains to be seen whether the surface indications which induced these favourable reports are borne out by results; or whether, as has been the case in so many Devonshire mines, they are found to lead to nothing. We fear that the lodes about Dartmoor are very deceptive; and that nothing but a personal experience of this will guard against grave mistakes. The writer of this has made mistakes about Dartmoor, and consequently—"as a burnt child dreads the fire"—regards the whole region rather distrustfully. During eighty years of working, the Dartmoor district has only made one profitable mine—Wheal Friendship—against an expenditure of probably a million of money.

The event which has probably created the most interest in Cornwall during the month, is the appearance of the new "Neath Copper Company" in the ticketings. This Company is represented by Mr. Horton Davey, of Redruth; the son of Mr. Stephen Davey, of the firm of Messrs. S. and R. Davey, and nephew of Mr. Richard Davey, M.P. for the western division. It is generally understood, however—and indeed it is a matter about which there is little doubt—that Mr. John Michael Williams is in the background, Mr. Horton Davey being his brother-in-law. Indeed, Mr. J. M. Williams is understood to have been long desirous of bringing Mr. Davey into the firm of Williams, Foster, and Co., but the arrangement was objected to by the other members of the Williams family; and it is said that this matter was one of the causes of the unhappy differences in that family, which have ended in the Court of Chancery. However this may be, Mr. J. M. Williams having filed a bill against his uncle, Mr. William Williams, of Tregullow, and other members of his family, for a dissolution and an account (in which he has recently succeeded), it is understood that the Mines Royal Company's Works at Neath were purchased, and the Neath Copper Company started, so that no time might be lost.

The notice of the Neath Company was given at the Camborne ticketing on the 5th June, by Mr. Downing, Solicitor, of Redruth, on behalf of Mr. Horton Davey—it being the custom for a new company to give fifteen days' notice before bidding. On this occasion no questions were asked; and at the sale of the 19th (the expiration of the fortnight), no bids were made on their behalf in consequence of samples not having been received in time. At the sale of the 26, at Truro, Mr. Francis Pryor being in the chair, representing West Caradon, the Neath Company's ticket was offered, and refused by Mr. Pryor. The course taken by Mr. Pryor on this occasion did not, for a moment, meet with the sanction of the public opinion of the county; and at the sale of the 31st (this day), the bids of Mr. Horton Davey were unanimously received. The position of Messrs. Davey in the county—and their unblemished honour—made the refusal quite unjustifiable, for no one has the least doubt as to the solvency of the Neath Copper Company. Whatever may be the personal sympathies as to the proceedings in Chancery—and they are strongly in favour of Mr. William Williams—they should not be imported into business matters.

We have received a communication, on behalf of Captain John Kendall, in reference to some remarks made in our last month's number, on the working of Wheal Charlotte and West Wendron Consols mines. This communication states—"The remarks in your last magazine, upon the management of Wheal Charlotte and West Wendron Consols, bore very hard on Captain Kendall, the nominal manager, I say *nominal*, for his

hands were completely tied by a London Committee in each mine, who effectually prevented his working either of the mines in the manner he, or any other good miner, would have desired." We are very happy, in justice to Captain Kendall, to receive this explanation; for he has hitherto had the reputation of being an excellent practical miner, which made the admitted mismanagement of the mines in question the more remarkable. Indeed, the writer of the remarks referred to has, on former occasions, spoken highly of the reputation and ability of Captain Kendall. The mismanagement of Wheal Charlotte and West Wendron were, however, notorious, and such as deserved reprobation in the interests of respectable Cornish mining; and for this, Captain Kendall, as "nominal" manager, was officially responsible, although we were satisfied it could never have been such as commended itself to his better judgment. But Captain Kendall was, of course, only the servant of the committees; and if the committees of these or any other mines chose to misconduct their affairs, it is out of the power of their agents to prevent them. When failure follows from this interference of committees, it often follows that they are the first to throw the blame on their agents, whose duty it then becomes, in justice to themselves, to do as has now been done on behalf of Captain Kendall, so that the burden may be thrown on the right shoulders. In the cases of Charlotte United and West Wendron, the mismanagement must consequently henceforth be put down to the interference of their respective London Committees.

WALES AND THE BORDERS.

South Wales.—in the coal and iron trades, confidence is being gradually restored in every branch of business. The public are looking forward with eagerness to the future, and it seems to be allowed on all hands that there can be no reasonable doubt of the return of better times. A decidedly better tone prevails in the iron trade since the last quarterly meeting of the iron masters. Both the Tredegar and Ebbw Vale Companies have large orders in hand; the latter have placed another furnace in blast at Aberyschan as well as re-opened the Bargwn Mine Pit. Messrs. Roper and Son have commenced erecting an additional furnace at Cwm Bran. Besides the signs of improvement in existing iron works, it is stated that Messrs. C. B. Marshall and Co. are about taking the Caerphilly works, where furnaces were erected many years since, but which were then prevented from proceeding from want of capital. The Osborne Forge, Pontypool, will also soon be at work. The old proverb says, "it is a long lane that has no turning;" let us hope that these districts have at last arrived at this turning.

The coal trade has not, as yet, manifested that improvement which is so apparent in the iron trade. The coalmasters complain that the coal which was formerly used at the iron works is now brought down to the different ports for shipment; still it is expected that the additional furnaces lighted, and other alterations, will be the means of consuming all this coal, and that the market will soon return to its normal condition. The shipping trade in the several ports is slack, yet there appears a steady trade in the interior of the country, and the colliers are generally well employed. A vigorous attempt has been made at Swansea to reduce certain charges in the harbour dues which tell heavily upon shipping. To further this object a public meeting was held recently at Swansea for the purpose of presenting a requisition to the harbour trustees, asking for a large and immediate reduction in these dues. This requisition was laid before the trustees of the Swansea Harbour at their meeting held in the Council Chamber on the 14th. After a short discussion the memorial was referred to a Special Committee to consider and report to the trust at the next meeting.

The extensive Penarth Docks at Cardiff are reported to be progressing

in a favourable manner; these, combined with the Bute Docks, will give accommodation and facilities not surpassed by any other South Wales port. The prospects of Newport are decidedly on the mend. The passing of the West Midland Additional Works Bill will no doubt be the means of largely increasing the trade of this port: the Bill gives to the West Midland Company running powers to the Newport Docks, and thus the Midland and Northern districts of the country will be brought into communication with Newport by an uninterrupted narrow gauge. It is expected that an import trade will be created through the connection with the Midland counties, and when this is accomplished we may see Newport ranking among the leading ports in the kingdom. It has been reported, on good authority, that a Company has been formed for the purpose of working the Bwhllfa Colliery, near Aberdare. This colliery was formerly the property of Mr. Ebenezer Lewis: the coal is said to be an excellent seam.

North Wales.—A Joint Stock Company, of the same name, has been formed for purchasing the Brymbo Lead Smelting Works near Minera, Wrexham. The nominal capital is 40,000*l.*, in 8,000 shares of 5*l.* each. The amount required for the purchase of the works, and for the necessary working capital, is estimated at 24,000*l.*; which is proposed to be raised by the issue of 6,000 shares at 4*l.* each. These works were erected some years ago, but their operations ended in failure. One of the Directors of the present Company, Mr. Thomas Edgeworth, of Wrexham, was, we believe, connected with the former Company. Still the position of the works is favourable for purchasing and smelting the lead ores of the local Denbighshire mines.

A Company has been formed in Glasgow, for working the Gefail-y-Minezs copper mines, near Maentwrog, Merionethshire. Capital 12,000 in shares of 1*l.* each.

A new Gold Company, called the Barmouth Consols Copper, Silver-Lead and Gold Mining Company (limited) has been advertised.

MIDLAND COUNTIES.

Derbyshire.—The coal trade, which has been most unusually depressed for a long time, is beginning to show signs of improvement. At Clay Cross, Staveley, and Butterley Works, the men are beginning to make more time, each of these firms having entered into large contracts, one of which is with a French firm. The London coal merchants are beginning to lay in their autumn and winter stocks, taking advantage of the present low price of coal. On the whole, it is hoped that the trade will be better, although it cannot be expected to improve in any great degree, so long as the manufacturing districts remain in their present state of dulness. There is an improved demand for iron for rails from France, and, for home requirements, this branch of trade is improving, and a more confident tone prevails in commercial circles. There is a falling off in the demand for iron from Russia. As regards armour plates, the large demands made for them by Government, make some firms very busy, and it is difficult for them to keep pace with the demand.

We are sorry to hear that the colliers employed in the Kimberley District are still on the strike, and though attempts have been made to arrive at a settlement, it does not seem probable that they will soon succeed. The men hold occasional meetings in different parts of the county, for the purpose of explaining their grievances. It is lamentable that these unfortunate differences cannot be settled, and a large number of families removed from a state of starvation.

It is said that an important discovery of a continuation of a coal field has been made on the Coton Park Estate, near the Gresley Station of the

Leicester and Burton Railway. The bed of coal is said to be identical with the main beds of the Moyra and Gresley Collieries.

STAFFORDSHIRE AND WARWICKSHIRE.—The quarterly meetings of the members of the iron trade where held on the 9th at Wolverhampton, and on the 18th at Birmingham. The attendance was not very numerous on either days, and the general tone of the meeting was rather quiet. The leading houses continue to report favourably of the condition of the trade. There has been a great demand from the United States, for as much iron as can be made by the American masters is taken by the Government; the general buyers have therefore to supply their wants elsewhere. It is required by the Federal authorities, that the plates supplied to the naval yards, and those also used by Government contractors shall be of American charcoal iron, they being largely influenced by the United States ironmasters, by whom they have been completely imbued with the conviction that no iron can compare with the American, and in particular that rolled from the pigs, smelted in that country with charcoal fuel.

Some tolerably valuable specifications for all descriptions of merchant iron, bars, hoops, sheets and plates, have been received, and a much larger number of orders have been sent from the markets and ports of the Baltic and Black Seas than could have been expected. There is now a marked activity in sheets for those ports at some of the leading houses. The general home demand is not good, and there are not many inquiries in the market. The weather must improve before any alteration for the better is experienced in this department. There are a good many inquiries afloat for iron for home use for pontoon bridge and viaduct work. The Danubian Steam Navigation and Colliery Company are also requiring six iron paddle-wheel steamers, four powerful steam tugs, two iron screw propellers, and about sixty iron barges. There is also a demand for sheets for roofing purposes, and for best boiler plates. In coal a tolerably good trade is being done, considering the season, for commercial as well as for domestic uses.

NORTHERN COUNTIES.

NORTHUMBERLAND AND DURHAM.—Trade here is in much the same condition as it has been at any time for the last two months. The coal trade remains just as before. The monthly statement of the blast furnaces in South Durham and Cleveland shows no advance on that of the previous month, precisely the same number being in action at both periods. The comparative monthly returns for the last four years are as follows:—

July 1, 1860	52 furnaces in blast;	22 out of blast.	Total 74
„ 1859	54 „	13 „	„ 67
„ 1858	49 „	14 „	„ 63
„ 1861	49 „	27 „	„ 76

The new winning at Camboise, near Blyth, is proceeding very favourably. The workmen have sunk through the clay and quicksand, which fortunately were only thin, and after a short depth of rock they came upon a stratum of coal and shale 4 feet 6 inches in thickness. At Monkwearmouth, new tubbing is being placed in the deep pit, which will henceforth be used solely as an up-cast, and for drawing coals.

At Sunderland, from the 5th to the 12th of the month, no less than fifteen vessels were set afloat on the Weir. On the 1st day of the month, there were 100 ships of various sizes in process of construction; twelve of these were iron screw steamers. Respecting the trade of Tyneside during the present year, the *Gateshead Observer* published among others the following interesting statistics:—"The exports of coal and coke for the first five months have risen from 2,704,381 ton in 1860, and, 2,995,109 tons in

1861, to 3,190,928 tons this year. France continues to be our best customer. Pig-iron exports have increased from 111,205 tons in 1860, and 154,670 in 1861 to 183,709 this year. Bar, bolt, and rod iron also show an increase over 1861, although not quite equal to 1860. Railroad iron, however, as might be expected, exhibits a decline, although not to any great extent. Cast-iron has increased to the extent of 1,000 tons. Hoops show an improvement as compared with last year, as does also cast-iron to the extent of 15 per cent. Steel has increased from 9,510 tons last year to 10,186 this. Of pig, rolled, and other lead the quantities exported (in tons) were in 1860, 9,240; in 1861, 7,246; and this year, 11,454. The exports of lead ore, red and white lead, and litharge of lead, were, in 1860, 2,696 tons; in 1861, 2,418; and in 1862, 3,684 tons. Amongst the imports were 208 ingots of lead from Gothenburg; two cargoes of pyrites from Huelvar, and a quantity of copper ore from Drontheim; a cargo of pyrites from Antwerp, and a cargo of iron pyrites from Pomaron.

Concerning the Consett establishment, this great hive of industry is gradually rising from the deep depression under which it recently suffered, and that the colossal establishment upon which its prosperity or otherwise, almost exclusively depends is now well employed, with a large number of orders on hand. It has attained considerable celebrity for its make of plates, and since Whitsuntide, the men have been employed on Mondays as well as other days in the week. A new blast furnace in course of erection, by Mr. Godley, the engineer, on a greatly improved plan, will turn out twice the ordinary quantity of metal, and other improvements are going on which show that no anticipation, at least, is entertained of decline or decay.

SCOTLAND.

At Glasgow, coals have been in moderate request. The pig-iron maket has been pretty steady, but the shipments have been rather under the corresponding period last year. The monthly shipment for the first quarter of the year, compared with the two previous years, have been as follows:—

	1862.	1861.	1860.
	Tons.	Tons.	Tons.
January	34,812	31,519	32,454
February................	38,627	29,738	95,278
March..................	55,399	42,554	46,928
Totals	128,838	103,811	104,660

Thus far—thanks in great part to the operation of the commercial treaty with France—matters went extremely well this year; but in the second quarter, the advance established was more than lost, for the figures stand thus:—

	1862.	1861.	1860.
	Tons.	Tons.	Tons.
April	53,160	62,622	50,585
May....................	70,461	82,036	66,701
June	42,167	57,201	40,712
Totals	165,788	201,859	157,998

The total shipments for the first halves of the three years were consequently :—

	1862.	1861.	1860.
	Tons.	Tons.	Tons.
First quarter	128,838	103,811	104,660
Second quarter...........	165,788	201,859	157,998
Totals	294,626	305,670	262,658

On the whole the results disclosed in these figures must be regarded as tolerably satisfactory. True, the fair promise of the first quarter of the year has not been sustained, but still a respectable advance has been established over 1860. The local consumption is, however, depressed and restricted, and as there are now 118 furnaces in blast, producing 20,000 tons per week, while the shipments and local consumption do not absorb more than 18,000 tons per week, the stock is accumulating at the serious rate of 2,000 tons per week. Irrespective of the amount held by the Carron Company, it is now reckoned at between 560,000 and 570,000 tons.

THE CONTINENT.

FRANCE.—Pig-iron, which has of late been maintained at a high price in the French iron trade, in consequence of the blast furnaces having had engagements to fulfil at long terms, is now more freely offered, many of the contracts having been completed. The coal trade of the Liège district is depressed, and no hopes are entertained of an improvement for the next two or three months.

BELGIUM.—With respect to the iron trade of this country the advices are of a more cheerful cast. The articles most sought after are rails, for which various contracts have been passed by the Northern of France and Southern of France Railway Companies. Large deliveries of plates have been made to France, even into the Departments of the South. The Swiss market, which has only been opened for three years, has become an outlet of great importance for Belgium ; English competition is stated to have been completely overcome in that direction, and the rivalry of the forges of the Franche Comté only remains to be dealt with. International transactions in iron minerals appear to be daily assuming large proportions. In the first five months of the current year, Belgium exported 87,244 tons of these minerals, of which 80,000 went to France ; while, on the other hand, she imported 43,254, of which 42,052 came from the Grand Duchy of Luxembourg. The Belgian iron trade will profit materially by the construction of thirteen new lines of railway, in respect of which the Government has applied to the Chambers for powers to grant concessions. The length of the contemplated extensions is rather more than 300 miles, - about one-fourth of the extent of the lines now in operation. The cost of the construction is estimated at 16,000*l*. per mile, or in round numbers 5,000,000 altogether.

SPAIN.—The report of the Spanish General Credit Company states, with respect to the mining enterprises promoted by the company, that on the termination of the northern of Spain railway system, the rich and numerons products of the collieries of Santullan will acquire an outlet of the greatest importance. The hopes entertained with respect to the mines of the company appear to be fully justified, even without waiting for the termination

of the Manzanares and Cordova Railway, which will put in relation with Madrid and the ports of the east the establishments possessed by the undertaking at Linarès and La Caroline. The company has, amongst its numerous other speculations, concessions of the privilege of lighting with gas the towns of Valladolid, Xerès, Alicante, Carthagena, Pampeluna, and Burgos; and in all these places, with the exception of Burgos, works are established, and are in full operation.

Metal Markets.

The following weekly reports from Messrs. Von Dadelszen and North, show the position of the metal market during the month:—

June 25th.—We have to report a steady market in metals during the past week, with but little change in values, the business done having been of an average amount.

IRON.—Welsh bar remained at *5l. 2s. 6d.* to *5l. 5s.* f. o. b. Wales with a good demand, and from *5l. 17s. 6d.* to *6l.* in London. Staffordshire unaltered. Scotch pig iron without much variation in price, closing at *52s. 3d.* cash m. n. warrants.

COPPER.—Some little business has been done in English manufactured at $10\frac{1}{2}$*d.* Tough cake and tile is still obtainable, considerably below official quotations. Burra, *93l. 10s.* to *94l.* Kapunda, *94l.* Chili, *84l.* in Liverpool.

TIN.—Official quotations for English without change. There is a fair demand for refined and common, sellers under market price. We quote straits *113l.* to *114l.* cash; Banca, nominally *120l.* At the Dutch sale, took place to-day, the average sales' price was $67\frac{3}{4}$ f. = *116l. 10s.* here.

TIN PLATES continue in fair demand, and makers being well supplied with orders, adhere firmly to previous quotations. We quote charcoal from *27s.* to *28s.*; coke, from *21s.* to *22s. 6d.* in Liverpool, *6d.* per box more in London.

LEAD is somewhat easier; we quote soft English *21l.*; W. B. *21l. 10s.*

SPELTER, although quiet, is very firm, the small stocks of the article giving confidence to holders, and they now ask *18l.* for spot parcels, WH.

July 2nd.—There has been a very much better feeling in the metal market during the past week than for some time past; prices have not altered materially, yet sellers hold out for full rates.

IRON.—Welsh bars are quoted *5l. 2s. 6d.* to *5l. 5s.* f. o. b. in Wales, and from *5l. 17s. 6d.* to *6l.* here, with a good demand. Staffordshire is as yet unaltered; the demand is very good, and we should not be surprised to hear higher rates ruling after the next quarterly meeting. Scotch pig iron has fallen to *51s.* $7\frac{1}{2}$*d.* cash, m. n.

COPPER.—English descriptions have stiffened in value, and manufacturers adhere to official prices. We quote, tough cake and ingot, *92l.*; Burra, *91l.* to *95l.*; Kapunda, *95l.*; Chili, in Liverpool, *85l.*

TIN.—A fair demand for English, both refined and common. We quote, Straits *113l.*, and Banca *116l.* cash.

TIN PLATES are in good demand, makers being well supplied with orders, in some cases at higher rates. We quote, charcoal from *27s.* to *28s. 6d.*, and coke from *21s.* to *22s. 6d.* in Liverpool; *6d.* per box more in London.

LEAD is quiet. We quote, good soft English, *21l.*; W.B., *21l. 10s.*

SPELTER is much neglected; prices, however, are firm. We quote, spot parcels, *18l.* for cash; W.H., *18l. 10s.*

July 9th.—A fair amount of business has been done in the metal market

since our last report; prices have been well maintained, and there appears every probability of a steady demand at present quotations.

WELSH BARS are in fair request, at from 5*l.* 2*s.* 6*d.* to 5*l.* 5*s.* free on board in Wales, and at about 6*l.* per ton free on board here. Staffordshire qualities are steady and in moderate demand. Scotch pig iron has given way since our last report, to 51*s.* 3*d.* cash.

COPPER.—Owing to the rise in the standard of ores, the smelters refuse to sell either manufactured or cake and ingot, under official quotations; but second hand parcels of the latter are obtainable a little under fixed prices. Burra has been sold at 95*l.*, and Kapunda is held for 96*l.* We quote Spanish from 87*l.* to 88*l.*, and Chili 86*l.* The 500 tons of re-melted copper coin were sold to-day in Holland, at 51f., equal to about 90*l.* delivered here net cash.

TIN.—The demand for English is of an average character, and a steady business has been done in Straits, at 113*l.* cash for consumption, and also at the same price with full prompt. Banca has been at 115*l.* 10*s.* delivered here, though mostly held for 116*l.* The Dutch market is nominally 68½f.

TIN PLATES continue in good demand for immediate delivery, and manufacturers insist on full prices.

LEAD is more offered. We quote good soft English 20*l.* 10*s.*, best brands up to 21*l.* 10*s.*

SPELTER.—The market is much firmer; holders are not at all anxious to realise. Business has been done in parcels on the spot here, at 18*l.* The demand for Birmingham is increasing, and the stock in Hull have materially decreased, holders are enabled to obtain advancing prices. Business has been reported at 18*l.* 2*s.* 6*d.* and 18*l.* 5*s.* cash, and WH is now quoted from 18*l.* 15*s.* to 19*l.*

July 16*th*.—The metal market remains in a firm position, and there is an average amount of business doing. An easy money market, together with the prospects of a good harvest, lead us to look for a general revival of trade.

IRON.—Welsh bars continue in fair demand, at from 5*l.* 2*s.* 6*d.* to 5*l.* 5*s.*, f.o.b. in Wales, and at about 6*l.* f.o.b. here. The better qualities of Staffordshire iron sell more freely at fixed prices. Scotch pig iron has hardly undergone any change since our last report, closing at 51*s.* 3*d.* cash, rather sellers.

COPPER.—English, both raw and manufactured, is in fair request, and only in isolated cases a trifle under official prices is accepted. The smelters are pretty full of orders, and refuse to sell under official quotations. Burra, 95*l.*; Kapunda, 96*l.*; Spanish, 90*l.*

TIN.—English unaltered in value. Straits is taken for consumption, at 113*l.* cash, and is obtainable at the same with full prompt. Banca, 115*l.* to 116*l.* The Dutch market is steady, at 68f.

TIN PLATES are without change; in consequence of the increased duty in America, shipments are pressed forward as fast as possible.

LEAD is very quiet, but unaltered in value.

SPELTER remains firm. A good business has been done in Hull parcels, at from 18*l.* to 18*l.* 5*s.*, according to brand; the stock there is much reduced and holders are very firm. Parcels on the spot here, we quote 18*l.*, WH 18*l.* 15*s.*

Metallic-Ore Markets.

TIN.—The standard for black tin remains unaltered at—

Refined	£102—1
Common	101

The hoped for advance in the tin-standard has not taken place, but the demand for good tin is firm, and the miner anticipates that this advance will not be delayed much longer. Although there is no nominal advance in quotations many recent parcels sold, have realized more than the nominal standard. Some parcels of black tin have been purchased by the New Redruth Smelting Company, but it is not reported that they have began to smelt. Time will show whether the operations of this Company will have any effect on the market.

Copper.—At the four Cornish sales we give this month, the number of tons, average produce, quantity of fine copper, average price per ton, and standard, have been as follows:—

Date.	*Tons.*	*Produce.*	*Fine Copper.* Tons. cwt.	*Price per ton.*	*Standard.*
June 26.	2,515	$6\frac{3}{8}$	161 4	£4 14 0	£116 4 0
July 3.	2,851	7	199 13	5 11 0	118 7 0
„ 10.	2,722	$6\frac{5}{8}$	181 6	5 6 0	121 0 0
„ 17.	5,446	$6\frac{1}{2}$	351 5	5 0 6	120 8 0

At the sale of the 26th, according to the *West Briton*, the Standard advanced 1*l.* 5*s.*, but, according to the *Mining Journal* only 18*s.* At the sale of July 3rd, according to the *West Briton*, there was an advance in the Standard of 4*l.*, according to the *Mining Journal*, 4*l.* 10*s.* At the sale of July 10th the Standard advanced 1*l.* 5*s.* according to the *West Briton*, but only 15*s.* according to the *Mining Journal*. At the sale of the 17th, according to the *Mining Journal*, there was a decline in the Standard of 2*l.*, but according to the *West Briton* of only 1*l.* 10*s.*

It will be seen that a gradual rise took place in the Standard until the last ticketing, when there was a decline, which is to be in some decree accounted for as being the heavy eastern sale. Our readers will remark that there is an addition to the ticketing list in the shape of a new company, called the Neath Copper Company, referred to in another part of our pages.

London Share-Market.

During the month the market for mining shares has been less buoyant, and prices generally have not been maintained. An advance has taken place in West Tolgus and East Pool, consequent on improvements in the respective mines; and the fluctuations in Wheal Ludcott have been of a daily character, ranging from 12 to 25, and in a week the extreme range has been accomplished. The other features of the market have been of a common-place character.

The payments of the July dividends, the favourable exchanges attracting larger quantities of gold to our shores, and the perfect paralysis under which the trade of Lancashire is at present suffering, have combined to reduce the price of money to a point at which only on one previous occasion has it ever touched. In the open market money is readily obtainable at $1\frac{3}{4}$ per cent., or $\frac{1}{4}$ under the Bank's minimum.

Speculation has turned to Foreign Loans; and on the last day in July no less than three were announced, viz., for Venezuela, Peru,

and a second issue of Egyptian—all of which command high premiums.

In the month the old Egyptian Loan has risen 10 per cent., Turkish Scrip 3 per cent., Venezuelan 4 per cent., and most others in a similar ratio.

Joint Stock Banks and Railways have come in for a share of patronage in a second degree, and participated in the general buoyancy.

Consols have risen about 3 per cent., and the bullion in the Bank has reached a higher total than at any period since April, 1859.

Under the influence of cheap money the market for metals has assumed a firmer tone, nevertheless the market for mining shares has not in the least participated, dullness being the prevailing characteristic and sales being difficult to effect. The brokers and dealers attribute the stagnation which has so suddenly come over the market to the recent violent fluctuations in Ludcott. the extensive speculation still being carried on, and to the disappointment experienced by the falling off in the value of the silver deposit.

Early in the month shares rose to 25*l*., in a week fell to 12*l*., afterwards rallied to 25*l*., and again fell to 12*l*. The reports from the mine are of the most conflicting character; it is, however, admitted that the rich deposit of silver in the winze being sunk below the 70 which was valued at 1,200*l*. per fathom, and on which the shares rose so suddenly, is now of little value. The violent fluctuations in the shares have also been precipitated by the failure of one or more country speculators to keep their engagements. To the credit of the members of the Mining Exchange none of them failed on the settling day to fulfil their obligations to the letter, notwithstanding the heavy losses entailed by the operations of others.

East Basset shares have advanced to 48*l* on an improvement in the lode in the shaft sinking below the 90; the dividend on the 29th was 2*l*. per share.

Wheal Seton shares have been largely dealt in: the ends are producing an aggregate of 35 tons. The sunk shaft is down to the 150, and a cross-cut commenced to intersect the lode, the prospects are favourably reported on and shares have risen to 140*l*.

South Frances, the lode in the 74 ft. levels east and west, are worth respectively 35*l*. per fathom; the next dividend will be 2*l*. per share.

East Pool, the lode has been cut into at the 150 6 ft., and so far as seen is richer than in the level above. This mine is divided into 128 shares, and commands a market value of 425*l*. to 450*l*.

East Caradons have been moderately steady, the dividend declared at the meeting was 17*s*. 6*d*. per share; the report was favourable, and the lode at the 70 is expected to be intersected in about a month. No material change has taken place in the workings, an improvement is looked for in the lode in the 60, as the hard bar of ground that rendered the lode of less value in the 50 for some distance, is nearly passed through; shares have ranged between 44 and 46.

East Carn Brea shares have suffered heavily in the general depression being last quoted 13½, 14. Dividends may be expected

from this mine this year, and the prospect for a continuance of profit are good. The lode in the 40 east is worth 3 tons; the winze below the 40, 4 tons; winze below the 40, east of eastern shaft, 4 tons; lode in the new shaft sinking below the 26, 3 tons.

Wheal Union: The lode in the flat rod shaft is 4 feet wide, producing good stones of ore, and in the 18 fathom level 8 feet wide of gozzan and stones of ore. This mine is working on the Carn Brea lodes, and likely to prove a profitable undertaking; shares are steady at 4¾-5. Great South Tolgus 4½ to ½. The lode in Lyle's shaft is valued at 50*l*. per fathom for tin. North Tuskerby shares have fluctuated been 30*l*. and 40*l*., finally closing at 32½*l*. sellers.

Buller, 55 to 60. The prospects are not so favourably reported on.

Basset shares are steady at 82½ to 85. The mine is rather poor, but there are many important points to come off in this fine old mine.

West Seton shares are flat at 225.

Carn Brea, 65 to 70. The mine is looking well; the returns of copper ore will be considerably increased, as in about a week's time the new engine on the Highburrow lode will be set to work.

Devon Great Consols are in demand, and have risen to nearly 450*l*. South Caradon shares find buyers at 335*l*.

West Tolgus have fluctuated between 50 and 56. Closing less firm.

Great Fortune shares have been firm all the month, and touched as high as 30*l* The dividend declared at the meeting was 10*s*. and the report read was of the most favourable character.

An improvement has taken place in Treloweth Mine, in the 134 fathom level in easy ground, worth 20*l*. per fathom.

Grenville shares have fluctuated between 6 and 8*l*. The tin lode at the 80 fathom level is opening up an important feature.

Marke Valley's have risen to 10*l*.

West Basset shares have been at one uniform price all the month, viz., 12½, 13; the dividend declared at the meeting was 8*s*.

North Crofty shares have risen to 3¾, 4; this old mine is likely in time to take her place among the rich mines. In this great tin producing district an important improvement has taken place in the lode in the 170 west at the other side of the elvan course, now worth 18*l*. per fathom; this level has not been unwatered for 20 years, till the present time.

Cook's Kitchen at 30; Tin Croft at 11; Wendron Consols at 10½; Stray Park at 31; Condurrow at 60*l*.; have all been free from fluctuation and without change and note in the workings.

In Foreign undertakings St. John Del Reys are less firm at 57 to 58; Santa Barbara in demand at ¾ ⅞ premium. Quebrada land and mining in Venezuela, under the able management of Messrs. Dunsford and Rankin, has been succesfully launched, the shares are at a premium, and the undertaking bids fair to be one of our most successful Foreign projects.

Otëa, another foreign company, is introduced under respectable auspices; a reasonable price is charged for the concession, the direction is respectable, and the field of operation judiciously chosen, the prospects are of a high order.

Thursday, July 31*st*, 1862, 2 P.M.

The following are the closing prices of mining shares this day :—

Bryn Gwiog, 24 to 25; Caradon Consols, 16 to 17 ; Cook's Kitchen, 30 to 31 ; Carn Camborne, $1\frac{1}{8}$ to $1\frac{1}{4}$; Devon Great Consols, 445 to 450 ; East Basset, 48 to 50 ; East Caradon, 44 to $44\frac{1}{2}$; East Devon Great Consols, $13\frac{3}{4}$ to 14 ; East Rosewarne, $2\frac{3}{4}$ to $2\frac{7}{8}$; East Wheal Grenville, $2\frac{1}{4}$ to $2\frac{1}{2}$; East Wheal Russell, 3 to $3\frac{1}{4}$; Great South Tolgus, $4\frac{1}{4}$ to $4\frac{1}{2}$; Great Wheal Fortune, 29 to $29\frac{1}{2}$: Herodsfoot, 38 to 40 ; Long Rake, 12 to $12\frac{1}{2}$; Marke Valley, $9\frac{3}{4}$ to 10 ; Minera Mining Company, 160 to 165 ; New Wheal Seton, 90 to 95 ; North Dolcoath. $1\frac{1}{8}$ to $1\frac{1}{4}$; North Downs, $3\frac{1}{2}$ to $3\frac{3}{4}$; North Roskear, 25 to 26 ; North Wheal Basset, 4 to $4\frac{1}{4}$; North Wheal Crofty, $3\frac{3}{4}$ to $3\frac{7}{8}$; North Wheal Robert, $1\frac{1}{16}$ to $1\frac{1}{4}$; Providence, 41 to 42 ; Rosewall Hill and Rosewall United, 4 to $4\frac{1}{4}$; Rosewarne United, 10 to 11 ; South Caradon, 340 to 345 : South Carn Brea, $2\frac{1}{2}$ to $2\frac{3}{4}$; South C. Wheal Hooper, 17*s.* 6*d.* to 20*s.* ; South Wheal Frances, 105 to 110 ; Stray Park, 30 to 32 ; Tincroft, 11 to $11\frac{1}{4}$ to $11\frac{1}{2}$; Wendron Consols, 10 to 11 ; West Caradon, 33 to 35 ; New Wendron Consols, $2\frac{1}{2}$ to 3 ; Wheal Basset and Grylls, 10 to 11 ; Wheal Grenville, $5\frac{7}{8}$ to 6; Wheal Grylls, 31 to 33; Wheal Ludcott, 13 to 14; Wheal Seton, 138 to 140 ; Wheal Trelawney, 15 to 16; Wheal Union, $4\frac{7}{8}$ to 5 ;Wheal Uny, $7\frac{1}{2}$ to 8.

Provincial Share Market.

DUBLIN.—The following report is condensed from the *Mining Journal*: Towards the end of June, the shares of the Wicklow Copper Mining Company suffered a slight reduction on their recent recovery, and were weak at 41*l.* per share. And although the Directors of the Mining Company of Ireland recommended for this half-year a dividend of 14 per cent. on the amount paid up, being an advance of $1\frac{1}{2}$ per cent. on the previous half-year, their shares were rather weak for delivery, but for the end of July 18*l.* 7*s.* 6*d.* freely offered. Connorree Mine shares on sale at 26*s.*, and Carysforts offered at 16*s.* For General Mining Company's shares there was no demand.

In the beginning of July the shares of the Mining Company of Ireland, though the company's principal revenue is derived from lead and copper ores, not so much subject to fluctuations in price as sulphur or iron pyrites, have also, but in a less degree, suffered by the dullness of the market, and changed hands at 18*l.* 10*s.* Shares of smaller descriptions, and of a more speculative character, apparently suffered least, quotations having been kept up by small transactions. Carysfort shares reported as having been enquired for at 16*s.* (20*s.* paid); and Connorree shares at 26*s.* For the shares of the General Mining Company for Ireland 4*l.* 7*s.* 6*d.* was said to have been offered, but no quotations were made.

Towards the middle of the month, transactions on the Mine Share Market were not very numerous. A few Wicklow Copper shares were sold at 37*l.* 5*s.* The Mining Company of Ireland shares hold their ground. Carysforts, before the half-yearly meeting of shareholders, reached par, or 1*l.*, and those of 2*l.* 10*s.* paid 40*s.* ; but since that they receded, the former to 17*s.* sellers, and the latter to 34*s.* do. Connorrees offered at 26*s.* 6*d.* General Mining Company, sellers at last rate.

Later on in the month, the Wicklow Copper Company's shares, from the low figure of 37*l.* 5*s.*, have risen to 40*l.* for cash or account—being a rise 2*l.* 15*s.* The Mining Company of Ireland shares were rather flat, business having been done at 17*l.* 10*s.* for cash and account. Not much business done in the following mines, and rather flat at the quotations—Carysfort (50*s.* paid), 33*s.* ; (1*l.* paid), 16*s.* 6*d.* ; Connorree, 28*s.* ; General Mining Company for Ireland, 4*l.* 5*s.*

Tabular Abstract of Mining Accounts for the Month.

Date of Meeting.	Name of Mine, and Number of Shares.	Balances. Debit.	Balances. Credit.	Calls. Per Share.	Calls. Total.	Dividends. Per Share.	Dividends. Total
		£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d
	CORNISH AND DEVON MINES.						
June 20	Carn Brea (1 000)	—	6,743 0 2	—	—	—	—
" 20	Camborne Vean (4,600) ...	433 10 8	—	0 2 0	460 0 0	—	—
" 20	Wheal Trerew (512)	126 17 3	—	0 10 0	256 0 0	—	—
" 23	Wheal Vyvyan (1,024) ...	979 4 5	—	1 0 0	1,024 0 0	—	—
" 23	West Tolgus (512)	432 6 6	—	—	—	—	—
" 23	Praed Consols	307 16 4	—	—	—	—	—
" 24	Pendeen Consols (5,000) ...	—	843 15 0	—	—	—	—
" 24	North Dolcoath (5,000) ...	170 0 0	—	0 2 0	500 0 0	—	—
" 24	Fowey Consols (4,940) ...	—	3,264 9 5	—	—	—	—
" 25	Rosewall Hill and Ransom United (6,000)	—	1,322 19 11	—	—	0 3 0	900 0 0
" 26	Ashburton United (1,000) ...	—	394 7 8	—	—	—	—
" 26	Wheal Uny (4,096)	1,263 4 9	—	0 4 0	819 4 0	—	—
" 30	Wheal Basset and Grylls (1,000)	—	263 11 1	—	—	—	—
" 30	East Pool (128)	—	350 11 3	—	—	2 10 0	320 0 0
" 30	Wheal Damsel (512)	445 19 6	—	1 10 0	768 0 0	—	—
July 1	Grambler and St. Aubyn (486)	295 4 11	—	1 0 0	486 0 0	—	—
" 2	Wheal Kitty, Lelant (4295)...	47 12 11	—	—	—	—	—
" 3	Trevenen and Tremenheere (5,600)	533 1 8	—	0 2 0	560 0 0	—	—
" 3	Tincroft (6,000)	—	—	—	—	0 5 0	1,500 0 0
" 4	Wheal Ludcott (4,800) ...	—	2,115 7 4	—	—	—	—
" 4	West Greatwork (4,620) ...	101 13 4	—	0 1 6	346 10 0	—	—
" 5	East Wheal Agar (1,190) ...	—	15 0 0	1 0 0	1,190 0 0	—	—
" 7	South Frances (496)	—	2,658 17 6	—	—	1 0 0	496 0 0
" 7	New Treleigh (6,000)... ...	1,727 19 5	—	0 4 0	1,200 0 0	—	—
" 7	East Devon Great Consols (4,000)	164 0 4	—	0 2 6	500 0 0	—	—
" 8	Stray Park (920)	644 8 8	—	0 14 0	644 0 0	—	—
" 8	North Treskeby (848) ...	—	131 2 1	—	—	—	—
" 8	Wheal Falmouth and Sperries (2,000)	424 15 0	—	0 5 0	400 0 0	—	—
" 9	Trencrom (1,024)	725 0 0	—	—	—	—	—
" 9	North Trelawney (4,108) ...	183 4 10	—	0 1 6	308 2 0	—	—
" 10	New Wheal Seton (400) ...	63 1 10	—	1 10 0	600 0 0	—	—
" 12	Par Consols (6,400)	—	4,624 9 11	—	—	—	—
" 14	West Wheal Damsel (256) ...	—	526 14 5	—	—	—	—
" 14	Maudlin Mines (6,000) ...	274 18 7	—	—	—	—	—
" 14	Bosewarne United (512) ...	866 16 9	—	1 13 10	866 2 8	—	—
" 14	Wheal Emily Henrietta (1 024)	—	—	0 10 0	512 0 0	—	—
" 15	North Roskear (700)	324 5 2	—	—	—	—	—
" 15	Wheal Buller (256)	—	798 14 7	—	—	—	—
" 16	East Treskerby (1,024) ...	481 2 9	—	0 15 0	768 0 0	—	—
" 16	East Margaret (1,024) ...	1,032 0 0	—	0 15 0	768 0 0	—	—
" 17	Marke Valley (9,000)... ...	—	3,824 16 0	—	—	0 3 0	1,350 0 0
" 17	East Caradon (6,144)... ...	—	5,771 6 4	—	—	0 17 6	5,376 0 0
" 17	Wendron Consols (1,024) ...	25 19 4	—	—	—	—	—
" 21	Wheal Prosper, Breage (790)	961 0 0	—	1 0 0	970 0 0	—	—
" 22	Wheal Moyle (6,000)	1,386 0 0	—	0 5 0	1,500 0 0	—	—
	WELSH AND IRISH MINES.						
July 5	Central Minera (2,500) ...	—	—	0 2 0	250 0 0	—	—
" 7	Carysfort (20,000)	—	1,155 14 9	—	—	—	—
" 11	Vale of Towy (20,000) ...	779 10 0	—	0 1 0	1,000 0 0	—	—
	Vigra and Clogau Copper Mining Company (4,200) ...	—	8,000 0 0	—	—	1 0 0	4,200 0 0

Prices Current of Metals.

From Messrs. JAMES and SHAKSPEARE'S, 10, Austin Friars, E.C.

			Per Ton.		
IRON	Bars	in Wales ..	£5 0 0	@	£5 5 0
	„	„ Liverpool	——		5 15 0
	„	„ London	6 0 0	„	6 5 0
	Nail Rods	„ Wales .	5 12 6	„	5 15 0
	„	„ Liverpool	6 10 0	„	7 0 0
	„	„ London	6 15 0	„	7 0 0
	Hoops (Staffordshire)	„ Liverpool	7 15 0	„	8 0 0
	„ „	„ London	8 5 0	„	8 10 0
	Sheets „	„ Liverpool	8 10 0	„	9 5 0
	„ „	„ London	9 0 0	„	9 10 0
	Bars „	„ Liverpool	6 15 0	„	7 0 0
	„ „	„ London	7 2 6	„	7 5 0
	Scotch Pig (No. 1. g.m.b.)	the Clyde	2 11 0	„	2 12 0
	Rails	in Wales	5 10 0	„	5 15 0
	Russian	C.C.N.D.	——		——
	Swedish—Hammered—	large sizes	10 10 0	„	10 15 0
	„ „	Indian sizes	11 5 0	„	11 10 0
STEEL	Hammered—faggot		——		15 10 0
	„ in kegs ¼ and ⅝ in...		——		14 10 0
COPPER	Australian and other *fine* Foreign		94 0 0	„	95 0 0
	Foreign Slab, for Prod. 96 per Cent.		——		85 10 0
	English Tile and Tough		92 0 0	„	93 0 0
	„ Best selected		95 0 0	„	96 0 0
			Per lb.		
	„ Sheets, Sheathing and Rod		10¼*d.*	„	10½*d.*
	„ Flat Bottoms		10¾*d.*	„	11*d.*
YELLOW METAL	Sheets, Sheathing and Rod		8¼*d.*	„	8¾*d.*
			Per Cwt.		
TIN .... English ..	Common Blocks and Ingots		——		114*s.*
	„ Bars (in barrels)		——		115*s.*
	Refined		——		119*s.*
Foreign ..	Straits		——		113*s.*
	Banca		——		115*s.* 6*d.*
			Per Box.		
TIN PLATES at Liverpool 6*d.* Less	Charcoal IC, best..............		28*s.*	„	29*s.*
	„ IX „		34*s.*	„	35*s.*
	Coke IC		22*s.*	„	23*s.* 6*d.*
	„ IX		28*s.*	„	29*s.* 6*d.*
			Per Ton.		
LEAD..........	Sheet		——		21 0 0
	Pig—W.B.		——		21 10 0
	„ Ordinary brands		20 15 0		21 0 0
	„ Foreign, soft..............		19 15 0		20 0 0
	Red		——		22 0 0
	Shot		——		23 10 0
	Dry White...................		——		27 10 0
SPELTER	(Cake)		——		18 0 0
ZINC	(Sheet)		——		23 10 0
			Per Bottle.		
QUICKSILVER	(in bottles containing 75lbs. each)		——		7 0 0
			Per Ton.		
REGULUS OF ANTIMONY,	French Star		——		44 0 0

Business in Metals continues moderate, and without changes in quotation.

Copper Ores.

Sampled June 11, and sold at Tabb's Hotel, Redruth, June 26.

Mines.	Tons.	Purchasers.	Price.	Mines.	Tons.	Purchasers.	Price.
South Caradon	93	7	£5 10 0	Fowey Consols	40	1, 5	£3 8 0
	77	9	6 3 6	Tywarnhaile	64	5	2 13 0
	76	7	10 14 0		63	3	4 6 0
	60	1, 6	13 13 6		53	3, 5	2 0 0
	59	1, 6	14 11 0		51	5	1 17 0
	58	10	5 0 6		49	1	1 12 6
	29	9	5 19 0	Clifford Amalgamated .	91	3	3 13 0
Great Wheal Busy	76	7	2 7 0	(United Mines)	48	2	2 8 6
	71	5, 6	3 17 6		32	7	2 3 6
	65	12	1 15 6		18	7	3 0 0
	59	5, 9, 10	2 11 6	Craddock Moor	62	2, 6	6 10 0
	53	10	1 15 6		61	6	7 3 6
	48	5, 7	3 4 0		56	1, 5	0 14 6
	31	12	2 17 0	Wheal Polmear	54	2, 6, 9	4 3 6
West Damse	67	3	3 19 0		50	1, 6	5 4 6
	66	3, 7	3 0 6		23	1	11 13 6
	61	10	3 2 0	South Crinnis	52	9	3 8 6
	60	6	4 16 0		41	1, 2, 5	4 14 6
	55	10	0 18 6	North Grambler.........	53	6	6 2 6
	51	3	3 19 6	Grambler & St. Aubyn	29	2, 5	4 6 6
Fowey Consols	80	1	5 10 0	Creeg Brawse	8	5	5 4 0
	74	1	6 4 6		3	5	8 18 0
	68	1, 5	5 16 0	New South Ellen	10	5	7 6 6
	62	5	4 16 0	East Tolgus..............	6	3	3 7 0

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.		Tons.	Amount.
South Caradon	452	£3,943 2 6	Wheal Polmear	127	£755 4 6
Great Wheal Busy	403	1,057 1 0	South Crinnis	93	371 16 6
West Damsel	360	1,195 0 0	North Grambler	53	324 12 6
Fowey Consols	322	1,707 1 0	Grambler and St. Aubyn	29	125 8 6
Tywarnhaile	280	720 9 6	Creeg Brawse	11	68 6 0
Clifford Amalgamated	189	572 3 0	New South Ellen	10	73 5 0
Craddock Moor	180	887 15 6	East Tolgus	6	20 2 0

EACH COMPANY'S PURCHASE.

	Tons.	Amount.		Tons.	Amount.
1 Vivian and Sons.............	405½	£2,558 3 6	8 Bankart and Sons	...	—
2 Freeman and Co.	152½	576 11 9	9 Copper Miners' Co.	195½	£951 18 4
3 Grenfell and Sons	311	1,190 7 0	10 Charles Lambert	246½	676 2 10
4 Crown Copper Co.	—	—	11 Newton, Keates & Co...	...	—
5 Sims, Willyams & Co. ...	412½	1,423 2 0	12 Sweetland and Co.	96	203 14 6
6 Williams, Foster & Co. ...	343½	2,437 17 3			
7 Mason and Elkington ...	352	1,803 10 6	Total	2515	£11,821 7 6

Average Produce, 6⅜.
Quantity of Fine Copper, 161 tons, 4 cwt.

Average Standard £116 4 0
Average Price per ton 4 14 0

Sundry Copper Ore Sales.

At Liverpool.

Mines.		Tons.	Price per ton. £ s. d.	Purchasers.	Amount of Money. £ s. d.
ex Thomas Blythe and Euphrates	Lot 1	63	13 2 0	Charles Lambert	6,768 3 9
"	2	63	12 16 0	Vivian and Sons	
"	3	63	12 16 0	ditto	
"	4	63	13 17 0	Charles Lambert	
"	5	63	13 4 0	ditto	
"	6	63	12 14 0	Vivian and Sons	
"	7	63	12 18 0	ditto	
"	8	23	37 7 6	Pascoe, Grenfell & Sons ...	
"	9	1½	55 5 6	Newton, Keates & Co. ...	
"	10	32	16 10 6	Williams, Foster & Co. ..	

Copper Ores.

Sampled June 18, and sold at Tyack's Hotel, Camborne, July 3.

Mines.	Tons.	Purchasers.	Price.
Clifford Amalgamated	117	3	£6 3 6
(Wheal Clifford)	114	3	5 10 0
	108	3, 5	5 10 0
	101	3	6 1 6
	100	3	6 1 6
	82	8	3 14 6
	80	8	5 3 6
	53	3	4 8 0
	52	3	3 14 6
West Seton	78	2	2 11 0
	59	7	8 14 6
	57	9	6 12 6
	55	7, 9	6 0 6
	52	10	3 17 6
	50	2	8 7 6
	49	9, 10	4 4 0
	33	1, 12	0 11 6
South Tolgus	62	2	5 11 6
	60	7, 10	3 7 0
	56	1, 6	7 15 6
	46	9	5 3 6
	45	10	4 0 6
South Frances	51	4, 6	7 7 6
	36	1	6 8 0
	33	1	10 9 6
	32	9	5 0 0
	30	1, 8	6 0 6
South Frances	11	7	£2 18 6
Wheal Seton	24	7	3 12 0
(Pendarves)	68	1	6 18 6
	52	7	4 10 6
	35	3	14 11 0
North Roskear (Enys)	77	5	8 13 0
	19	10	2 0 6
(Basset)	46	5	3 14 0
(Pendarves)	35	4, 6	4 13 6
East Basset	74	7	6 18 6
	48	1, 5, 7	5 6 6
	32	9	8 10 0
Wheal Basset	53	7	7 3 6
	42	1	6 3 6
	30	7, 9	6 5 6
	21	1, 5	7 4 6
East Pool	73	4, 5, 6, 7	3 16 6
	62	10	4 1 6
North Crofty	60	1, 6	1 0 0
	54	4, 6	5 16 6
Tolcarne	37	5	6 0 0
	36	5	5 5 0
West Stray Park	70	4, 6	5 19 6
Tresavean	37	1	1 15 0
	8	1	2 8 6
Wheal Harriett	31	9	4 10 6
North Frances	25	7	6 15 0

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.
Clifford Amalgamated	807	£4,310 18 0
West Seton	433	2,266 5 6
South Tolgus	269	1,401 4 6
South Frances	193	1,325 2 6
Wheal Seton	179	1,301 17 0
North Roskear	177	1,038 7 0
East Basset	154	1,040 1 0
Wheal Basset	146	979 12 0
East Pool	135	£531 17 6
North Crofty	114	374 11 0
Tolcarne	68	411 0 0
West Stray Park	70	418 5 0
Tresavean	45	84 3 0
Wheal Harriett	31	140 5 6
North Frances	25	168 15 0

EACH COMPANY'S PURCHASE.

	Tons.	Amount.
1 Vivian and Sons	340	£1,[illegible]99 2 0
2 Freeman and Co.	190	963 6 0
3 Grenfell and Sons	626	3,803 14 0
4 Crown Copper Co.	123½	706 1 7
5 Sims, Willyams & Co.	294½	1,775 12 5
6 Williams, Foster & Co.	181½	953 6 7
7 Mason and Elkington	404½	2,445 7 11
8 Bankart and Sons	177	809 16 6
9 Copper Miners' Co.	265	1,540 4 [illegible]
10 Charles Lambert	232½	877 3 [illegible]
11 Newton, Keats & Co.	—	—
12 Sweetland and Co.	16½	9 9 [illegible]
Total	2951	£15,7[illegible] 4 [illegible]

Average Produce, 7.
Quantity of Fine Copper, 199 tons 12 cwts.

Average Standard £118 7 [illegible]
Average price per ton 5 11 [illegible]

Copper Ores.

Sampled June 25, and sold at Tabb's Hotel, Redruth, July 10.

Mines.	Tons.	Purchasers.	Price.	Mines.	Tons.	Purchasers.	Price.
East Carn Brea	69	7	£3 9 0	Treworlis	68	1, 5	£3 5 6
	68	6	9 5 6		59	1, 5, 8	3 3 6
	55	9	3 9 0		50	1, 5	7 11 0
	51	7, 21	8 4 0	Tolvadden	48	8	3 12 6
	48	1	13 2 0		37	8	3 14 6
	43	9	3 14 0		33	8	3 12 6
	41	2	4 15 0		22	2	7 18 6
	31	7	4 14 0		12	1, 5	10 15 6
	15	2	3 6 6		2	7	26 0 6
	14	1, 7	3 1 6	Copper Hill	60	5	1 19 6
West Basset..............	85	9	5 7 0		43	5	4 3 0
	79	9	5 8 6		42	5	5 6 0
	70	11	5 1 6	Wheal Agar..............	46	7	9 11 0
	62	9	5 13 0		39	11	6 10 0
	36	1	7 7 6		35	2	6 1 0
	31	9	4 9 0	West Alfred Consols ...	31	1	1 4 6
	30	9	5 12 0		20	1	1 8 0
	27	7	10 12 6		17	1	1 16 0
Alfred Consols	66	7	3 17 6		15	1, 5, 10	1 2 6
	62	12	2 17 6		12	2	4 18 6
	46	5	3 14 0	North Basset	52	8	3 6 6
	38	10	1 3 0		42	9	4 4 0
	33	7, 10	1 10 0	South Crenver...........	56	7	2 8 6
	28	1, 6	11 12 6		21	7	0 19 0
	10	1	2 8 6		16	7	5 4 0
Par Consols..............	83	7	6 18 0	Wheal Buller	44	5	4 19 0
	78	6	9 7 0		34	1	9 11 6
	76	6	7 3 0	East Rosewarne	27	3	4 17 0
	30	1	3 18 6		24	3	7 6 6
Wheal Margery	73	10	2 12 6		21	1	10 17 6
	72	6	7 15 6	Wheal Trevelyan	45	1, 5	5 17 0
	64	1	3 1 6	South Carn Brea	28	10	5 5 0
	4	1	15 5 0	Trumpet Consols	3	12	13 15 6

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.		Tons.	Amount.
East Carn Brea	435	£2,697 19 6	West Alfred Consols	95	£172 11 0
West Basset......................	420	2,447 4 0	North Basset	94	349 6 0
Alfred Consols	283	1,047 3 0	South Crenver	93	238 19 0
Par Consols......................	267	1,963 3 0	Wheal Buller	78	543 7 0
Wheal Margery	213	1,009 4 6	East Rosewarne	72	735 2 6
Treworlis	177	787 10 6	Wheal Trevelyan	45	263 5 0
Tolvadden	154	787 3 0	South Carn Brea	28	147 0 0
Copper Hill	145	519 11 0	Trumpet Consols	3	41 6 6
Wheal Agar......................	120	904 11 0			

EACH COMPANY'S PURCHASE.

	Tons.	Amount.		Tons.	Amount.
1 Vivian and Sons	433¼	£2,634 8 10	8 Bankart and Sons.........	189¾	£666 15 10
2 Freeman and Co.	125	689 16 6	9 Copper Miners' Co.	427	2,064 16 6
3 Grenfell and Sons	66	365 12 6	10 Charles Lambert	160½	412 14 0
4 Crown Copper Co.	—	——	11 Newton, Keates & Co. ...	134¾	817 17 0
5 Sims, Willyams & Co. ...	347¼	1,471 19 10	12 Sweetland and Co.	65	219 11 6
6 Williams, Foster & Co. ...	308	2,625 19 0			
7 Mason and Elkington ...	486	2,484 15 0	Total	2722	£14,454 6 6

Average Produce, 6⅝
Quantity of Fine Copper, 181 tons 6 cwt.

Average Standard £121 0 0
Average Price per ton 5 6 0

Copper Ores.

Sampled July 2, and sold at the Royal Hotel, Truro, July 17.

Mines.	Tons.	Purchasers.	Price.
Devon Great Consols	127	1	£4 10 6
	125	6	4 5 6
	123	6	3 17 6
	118	1	3 10 6
	117	3	8 4 6
	116	2	3 12 6
	112	1, 6, 7	3 18 0
	109	6	4 8 6
	102	2, 5, 10	1 19 6
	96	3	8 11 6
	93	10	3 12 0
	83	5	8 9 0
	79	10	4 4 0
	77	3	6 19 0
	72	10	2 19 6
	68	1, 10	3 2 6
	65	10	4 8 6
	64	5	3 15 6
	56	2	8 14 0
	55	10	4 19 6
	40	10	3 16 0
	21	3	8 4 0
East Caradon	98	1	5 6 6
	88	9	5 5 6
	73	8	10 18 6
	70	1, 5	8 6 0
	65	5	5 8 0
	56	8	5 16 6
Phœnix Mines	88	7	3 12 0
	87	7	3 5 6
	78	5	3 19 6
	73	5	3 16 0
	51	7	13 2 0
	50	7	9 18 6
Marke Valley	102	8	3 17 0
	79	8	4 6 0
	78	8	4 11 0
	58	6	6 0 0
	44	8	3 16 0
	24	12	2 0 6
Hingston Down	70	10	3 6 0
Hingston Down.........	67	9	4 16 0
	66	9	2 16 6
	65	10	3 6 0
	51	5, 9	3 10 0
	50	2	6 4 6
Great Wheal Martha	83	5	1 1 0
	80	1	0 18 6
	50	12	2 2 9
	42	1, 5	3 19 6
Holmbush	71	6	7 18 0
	67	1, 6	12 0 6
	60	5	9 7 0
	23	1	2 17 6
Bedford United.........	111	2, 6	5 19 0
	103	7	5 1 6
Lady Bertha	70	10	1 10 0
	50	5	2 10 6
	40	12	4 4 6
Wheal Friendship ...	83	9	3 10 0
	63	9	11 0 6
East Russell	55	1	6 9 6
	53	5	5 2 6
	32	5	5 0 6
Wheal Emma	49	8	3 17 6
	48	8	7 3 0
	37	12	1 11 0
Kelly Bray...............	49	1	1 11 0
	45	8	4 12 0
	26	7	3 4 0
South Bedford	70	12	3 5 6
	40	9	1 8 0
Gunnis Lake (Clitters)	62	5	4 3 0
	38	9	4 4 0
Wheal Yarner	77	5	2 13 6
Bampfylde...............	57	3	15 15 0
Brookwood...............	54	4, 6	5 13 6
	3	5	16 9 0
Gawton	45	4, 6	3 9 6
Fursdon	31	9	6 14 0
Howkmoor...............	30	7	4 16 6

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.
Devon Great Consols	1918	£9,270 13 0
East Caradon	450	3,041 15 6
Phœnix Mines....................	427	2,353 10 6
Marke Valley	385	1,783 2 0
Hingston Down	369	1,453 6 0
Great Wheal Martha.........	355	433 2 0
Holmbush	221	1,993 14 0
Bedford United	214	1,183 3 6
Lady Bertha	160	400 5 0
Wheal Friendship	146	985 1 6
East Wheal Russell	140	788 11 0
Wheal Emma	134	£590 8 6
Kelly Bray.........	120	366 3 0
South Bedford	110	285 5 0
Gunnis Lake (Clitters)	100	416 18 0
Yarner	77	205 19 6
Bampfylde..........................	57	897 15 0
Brookwood	57	355 16 0
Gawton	45	156 7 6
Fursdon	31	207 14 0
Hawkmoor...........................	30	144 15 0

EACH COMPANY'S PURCHASE.

	Tons.	Amount.
1 Vivian and Sons............	719 5-6	£3,110 6 9
2 Freeman and Co.	311½	1,626 6 6
3 Grenfell and Sons	368	3,390 12 6
4 Crown Copper Co..........	49½	231 8 3
5 Sims, Willyams & Co. ...	398½	4,131 4 6
6 Williams, Foster & Co....	661 5-6	3,512 6 0
7 Mason and Elkington ...	472½	2,662 7 0
8 Bankart and Sons	574	3,250 6 0
9 Copper Miners' Co.	501½	£2,469 17 6
10 Charles Lambert	677	2,316 6 6
11 Newton, Keates & Co...	—	—
12 Sweetland and Co.	221	609 4 0
13 Neath Copper Co...........	—	—
Total	5446	£27,313 5 6

Average Produce, 6¼.
Quantity of Fine Copper, 351 tons 5 cwt.

Average Standard £120 8 0
Average Price per ton............ £5 0 -

Copper Ores.

Sampled June 4, and sold at Swansea, June 24.

Mines.	Tons.	Produce.	Purchasers.	Price.		
Cuba	93	12¼	6	£9	6	0
	87	12¼	3, 6	9	7	0
	84	12¼	7	9	8	0
	82	12¼	7	9	8	6
	87	16¼	3	12	13	0
	48	20¼	3	16	5	0
(Precipitate S.J.M.)	2	72¼	6	58	5	0
Cobre	92	12¼	6	9	19	0
	91	12¾	6	9	15	0
	86	12¾	6	10	1	0
	75	12¼	3	10	2	0
	67	23	3	18	14	6
	64	22¾	7	18	16	6
Cobre	7	16¾	1	£13	2	6
Berehaven	113	10½	2, 7	8	3	0
	88	10¼	1	8	3	6
Koperberg	61	24¼	9	20	12	6
Ookip	48	33¼	7	28	4	6
Spectakel	40	26¾	13	22	15	0
	28	26¼	2	22	6	0
Sweepings	5	29	2	24	8	0
Laxey	137	6¼	7	5	4	0
West Aust. Mining As.	58	23¼	5	12	7	0
	57	23¼	10, 13	18	10	6
Knockmahon	92	12¼	2, 6	10	1	6

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.		
Cuba	483	£5,237	17	0
Cobre	482	5,975	14	0
Berehaven	201	1,640	7	0
Koperberg	61	1,258	2	6
Ookip	48	1,354	16	0
Spectakel	68	£1,534	8	0
Sweepings	5	120	0	0
Laxey	137	712	8	0
West Australian	115	2,178	4	6
Knockmahon	92	926	18	0

EACH COMPANY'S PURCHASE.

	Tons.	Amount.		
1 Copper Miners' Co.	95	£811	5	6
2 Freeman and Co.	135½	1,670	6	6
3 Grenfell and Sons	320½	4,299	7	0
4 Crown Copper Co.	—	—		
5 Sims, Willyams & Co.	58	1,122	6	0
6 Vivian and Sons	453¼	4,518	10	6
7 Williams, Foster & Co.	471¼	5,294	18	6
8 British and For. Copper Co.	—	—		
9 Mason and Elkington	61	£1,258	2	6
10 Bankart and Sons	28½	527	19	3
11 Charles Lambert	—	—		
12 Ravenhead Copper Co.	—	—		
13 Sweetland, Tuttle & Co.	68¼	1,437	19	3
14 Jennings and Co.	—	—		
Total	1692	£20,940	15	0

Black Tin Sales.

Data.	Mines.	Tons.	c.	q.	lbs.	Price per ton £	s.	d.	Purchasers.	Amount of Money. £	s.	d.
June 5.	Gt. Wh. Fortune	34	13	3	18	—			—	2398	14	5
	Garlidna United	6	19	1	27	66	7	6	Bissoe	567	10	9
	"	1	16	0	8	58	0	0	ditto			
" 11.	Ashburton United	7	8	0	12	67	7	0	Calenick Co.	1615	0	10
	"	7	11	3	21	67	5	6	Enthoven and Sons			
	"	7	15	0	19	67	6	6	Harvey and Co.			
	"	1	6	0	20	63	6	6				
" 12.	Kitty St. Agnes)	8	9	2	8	—			—	502	7	1
	Penhalls	6	11	0	21	—			—	413	4	9
	Wheal Uny	11	2	2	19	61	5	0	Bissoe	681	18	6
" 14.	West Wh. Jane	8	15	0	0	62	10	0	Calenick Co.	546	17	6
" 20.	Trevenen, &c.	6	18	1	25	68	10	0	Enthoven and Sons	529	17	4
	"	1	6	1	24	42	0	0	ditto			
	Wh. Vyvyan	1	7	1	2	62	10	0	ditto	93	17	1
	"	0	4	1	8	40	0	0	ditto			
" 28.	Basset and Grylls	22	7	0	0	—			—	1307	0	0
July 1.	Gt. Wh. Busy	11	7	0	15	—			Daubuz and Co.	643	0	11
	Wheal Prospidnick	3	16	2	23	—			—	238	2	3
" 2.	Wheal Grylls	25	11	3	21	63	2	6	R. Michell and Co.	1615	16	0
" 8.	Gurlyn	4	4	3	18	63	5	0	Chyandour	268	10	6
" 16.	St. Day United	35	16	0	18	—			Williams, Harvey	1924	13	5

Copper Ores.

Sampled July 2, and sold at Swansea July 22.

Mines.	Tons.	Produce.	Purchasers.	Price.			Mines.	Tons.	Produce	Purchasers.	Price.		
Berehaven	126	10¼	3	£8	16	0	Genoa	14	19¾	14	£16	17	0
	99	10½	8	8	18	6		1	13¼	6	11	5	0
	124	10¼	7	8	15	6	Italian ore	19	5¼	13	4	8	0
	122	10⅜	9, 11	8	16	6	Laxey	86	6¼	7, 10	5	6	6
	110	10½	11	8	16	6		60	4⅛	13	3	8	0
	104	10⅜	7	8	11	0	So. Australian...	77	16¼	1	13	13	0
	84	10⅜	1	8	10	6		48	16½	9	13	13	0
Cobre	96	12¼	3	11	0	0	Wheal Maria ...	44	24¼	11	21	6	6
	92	12½	3	11	2	6		10	20½	10	17	10	6
	91	12¼	3	10	17	6	Melbourne	27	15⅛	1	12	18	6
	69	13	3	10	19	0		4	13⅜	10	11	8	6
	53	13	11	10	19	0	Kanmantoo......	21	51½	5	45	1	0
	48	22¼	5	19	2	6		3	51½	14	45	0	0
	46	22¾	11	18	15	0	Almeria	17	6¼	2, 6	5	5	5
	44	22½	7	18	19	0		2	16½	6	13	12	0
	9	51½	5	43	10	0	Canoblas	18	17¼	10	15	2	6
Genoa	48	10⅝	13	9	0	0	Australian	14	45	5	39	5	6
	36	19½	2, 6	16	9	0	Gloster Slag......	6	42⅜	5	36	5	0
	14	15⅝	14	12	15	0		3	27¼	5	22	17	6
	9	20	14	17	7	0	Bathurst	3	20¼	14	17	8	0
	1	27	14	23	4	0		1	20	10	17	2	6
	39	7¾	7	6	3	6	New S. Wales ...	3	10	6, 14	8	2	0
	3	7¾	6	6	3	0	Australian	3	10½	10	8	17	6
	22	12⅜	7	10	5	6	British Reg.......	13	26	10	22	5	6
	10	12⅜	14	10	5	0	Norway	1	16	14	13	9	0

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.				Tons.	Amount.		
Berehaven	769	£6,733	3	6	Almeria	19	£116	9	0
Cobre..............................	548	7,410	16	6	Canoblas	18	272	5	0
Genoa	107	2,217	0	6	Australian	14	549	17	0
Italian ore	19	83	12	0	Gloster Slag	9	286	2	6
Laxey	146	661	19	0	Bathurst...........................	4	69	6	6
South Australian..............	125	1,706	5	0	New South Wales	4	24	6	0
Wheal Maria	54	1,113	11	0	Australian	3	26	12	6
Melbourne	31	394	13	6	British Regulus	13	289	11	6
Kanmantoo	24	1,081	1	0	Norway	1	13	9	0

EACH COMPANY'S PURCHASE.

	Tons.	Amount.				Tons.	Amount.		
1 Copper Miners' Company...	188	£2,116	2	6	9 Mason and Elkington......	109	£1,193	10	6
2 Freeman and Co................	26½	340	14	6	10 Bankart and Sons	92	1,055	10	0
3 P. Grenfell and Sons.........	573	5,817	1	0	11 Charles Lambert	314	3,890	4	6
4 Crown Copper Co.	—	——			12 Ravenhead Copper Co. ...	—	——		
5 Sims, Willyams & Co.	101	3,091	10	6	13 Sweetland, Tuttle & Co.	127	719	12	0
6 Vivian and Sons................	34	409	15	6	14 Jennings and Co.............	56½	909	1	0
7 Williams, Foster & Co.......	376	3,506	19	0					
8 British and For. Copper Co.	—	——			Total....................	1997	£23,050	1	0

Blende Sales.

Date.	Mines.	Tons.	Price per ton. £ s. d.	Purchasers.	Amount of Money. £ s d.
July 1.	Minera	30 ...	2 12 6 ...	W. Kenrick	260 0 0
	"	50 ...	3 0 6 ...	ditto	
	"	10 ...	1 10 0 ...	ditto	
	"	10 ...	1 10 0 ...	A. Courage and Co.	

Lead Ore Sales.

Dates.	Mines.	Tons.	Price per Ton. £	s.	d.	Purchasers.	Amount of Money. £	s.	d.
June 26.	Westminster	35	12	2	0	Adam Eyton	423	10	0
	Mount Pleasant	17	12	0	6	Walker, Parker & Co.	204	8	6
	Hendre Ucha	28	12	16	6	ditto	495	12	0
	"	10	13	13	0	ditto			
	Bryngwn	10	12	4	6	Adam Eyton	122	5	0
	Park	30	12	17	6	Walker, Parker & Co.	386	5	0
	Roman Gravels	17½	12	16	6	ditto	448	17	6
	"	17½	12	16	6	Adam Eyton			
	Pool Park	11	13	4	6	Walker, Parker & Co.	192	19	6
	"	4	11	17	6	ditto			
	Lower Park	6	12	8	6	Adam Eyton	74	11	0
	Dyfngwm	17	12	15	6	Walker, Parker & Co.	217	3	6
	Rhoswydol	10	11	18	0	Adam Eyton	119	0	0
	Llanerchyraur	13	14	6	6	Walker, Parker & Co.	184	4	6
	Wheal Jane	18	13	10	0	Michell and Son	303	0	0
	"	6	10	0	0	Stock and Co.			
	Cefn Cilcen	8¾	12	10	0	E. Tregilgas	109	2	6
" 28.	Wheal Mary Ann	60	25	0	0	Stock and Co.	2035	10	0
	"	45	11	18	0	Sims, Willyams & Co.			
" 30.	Dyliffe	66	12	18	6	Walker, Parker & Co.	2321	3	6
	"	60	12	17	6	ditto			
	"	53	13	2	6	ditto			
	Tassan	20	11	16	6	ditto	473	0	0
	"	20	11	16	6	Newton, Keates & Co.			
	East Logylas	70	12	4	6	Walker, Parker & Co.	855	15	0
	Glogfach	60	15	13	6	ditto	940	10	0
	Cwmystwith	100	12	13	0	Sims, Willyams & Co.	1265	0	0
July 1.	Minera	100	12	6	6	James McNicol and Co.	6585	18	3
	"	100	11	19	6	Locke, Blackett & Co.			
	"	100	11	19	6	ditto			
	"	84	11	19	6	ditto			
	"	100	12	1	6	Panther Co.			
	"	49	12	6	6	James McNicol and Co.			
	"	14	10	13	6	Locke, Blackett & Co.			
	North Porthilly	2	11	15	6	Treffry's Executors	23	11	0
	Castleward United	40	12	7	0	Sims, Willyams & Co.	494	0	0
" 4.	Wheal Frank Mills	65	17	2	6	Stock and Co.	1713	2	6
	"	40	15	0	0	T. Somers			
	South Exmouth	19	12	17	6	Treffry's Trustees	490	3	0
	"	19	12	17	6	Walker, Parker & Co.			
" 10.	Talargoch (Maesyrerwddu)	58½	13	4	6	ditto	1318	15	3
	" (Coetia Llys)	39½	13	16	0	Newton, Keates & Co.			
	Deep Level	6	12	3	6	Walker, Parker & Co.	73	1	0
	Holywell Level	10	14	8	6	ditto	144	5	0
	Brynford Hall	12¼	11	18	6	Newton, Keates & Co.	228	17	0
	"	6¾	12	5	6	Walker, Parker & Co.			
	Herward United	7½	11	13	6	A. Courage and Co.	87	11	3
	Rhosesmor	50	12	12	6	Walker, Parker & Co.	1199	7	6
	"	22½	12	12	6	ditto			
	"	22½	12	12	6	Adam Eyton			
	Orsedd	3½	12	8	6	ditto	43	8	0
	Parry's	31	12	17	6	ditto	437	15	0
	Bryngwiog	45	13	9	0	ditto	605	5	0
	Long Rake	10	13	2	6	Walker, Parker & Co.	131	5	0
	North Henblas	6	12	0	0	Newton, Keates & Co.	72	0	0
	West Merllyn	5	12	12	6	Walker, Parker & Co.	63	2	6
	Grosvenor	4	13	0	0	Adam Eyton	52	0	0
	Llangynog United	20	12	10	6	Walker, Parker & Co.	250	10	0
	Nant-y-Iago	10	12	6	6	Newtown, Keates & Co.	123	5	0
	Dyliffe	35	13	2	6	ditto	2034	7	6
	"	35	13	2	6	Adam Eyton			
	"	55	13	2	6	Newton, Keates & Co.			
	"	30	13	2	6	Walker, Parker & Co.			
	Bronfloyd	25	13	0	0	Panther Co.	325	0	0
" 11.	Llanfyrnach	30	13	1	6	ditto	392	5	0
	Laxey	100	16	10	0	ditto	1650	0	0
	Cargoll	85	14	9	6	T. Somers	1230	7	6
" 14.	Frongoch	85	12	5	0	Panther Co	2096	5	0
	"	85	12	8	0	ditto			
	East Darren	80	15	5	6	Walker, Parker & Co.	1222	0	0
	Cefn Brwyno	58	12	10	0	Panther Co.	725	0	0
	Cwm Erfin	23	15	5	0	Treffry's Estate	850	15	0
	"	32	15	12	6	ditto			
	Holmbush	23¼	16	12	6	Michell and Son	386	10	7½

THE

MINING AND SMELTING MAGAZINE.

SEPTEMBER, 1862.

The Tunnel under Mount Cenis.

THIS tunnel, which is one of the most remarkable mining works of the age, is destined to unite the two branches of the Victor Emmanuel Railway, which at present terminate at Suze, in Italy, and Modane, in Savoy—the passage of the Alps between these two stations being made by the famous Mount Cenis road, which attains an elevation of 6,330 feet above the sea level.

On the southern (Italian) side, from Suze to the entrance of the tunnel, the railway does not follow the line of this great road, but bends to the south-west from that village, by the valley of the Dora, as far as the village of Oulx. Here it leaves the main valley, and the Briançon road, and turns towards the east by the lateral valley of the Thabor, up which it proceeds to the hamlet of Bardonnèche, where the valley terminates in the Alpine precipices and gorges of the main mountain chain.

From Oulx to Bardonnèche, the aspect of the country is wild in the extreme; and as the mouth of the tunnel is approached the rocks become gradually precipitous. Indeed, the entrance of the tunnel is at a point where winter begins in the month of September and does not end until June, and where the difficulty of the work is enormously increased by the rigour of the weather and the almost inaccessible position of the locality, which has made it necessary for workshops of every kind to be permanently erected on the spot. The mouth of the tunnel, which is some little way from Bardonnèche, is at an elevation of 4,380 feet above the level of the sea.

From this point to the northern end of the tunnel, in Savoy, above the valley of the Arc, near the village of Modane, the distance is 13,375 yards, or about 7$\frac{3}{4}$ miles. The elevation of the northern (Savoy) end is 3,945 feet above the sea level, or 435 feet lower than the Italian end. In order to allow for this difference of level, the northern (Savoy) half of the tunnel has a fall, from the middle to the mouth (a distance of 6,687 yards), of 445 feet, which gives a gradient of $\frac{1}{45}$th, or 22 in 1,000. The southern (Italian) half has only a fall of 10 feet in the 6,687 yards, which shows a gradient of

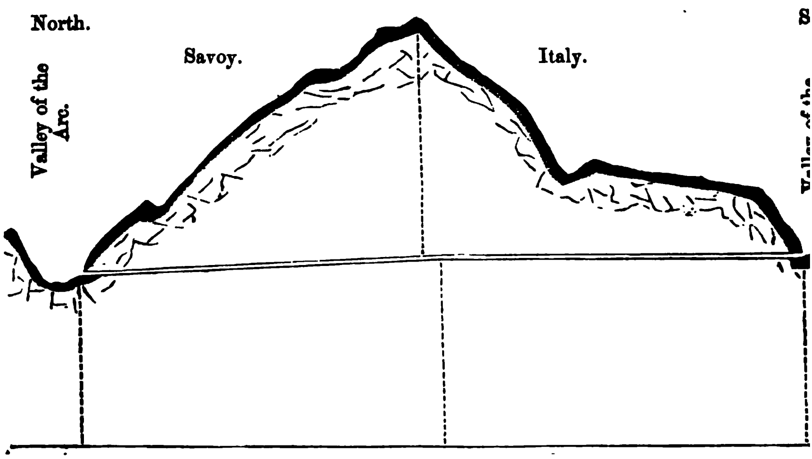
only $\frac{1}{2000}$, or 1 in 2,000—merely sufficient to secure the flow of the water.

The middle of the tunnel has, consequently, an elevation of 4,391 feet above the sea level. The portion of the mountain immediately over this—the Col de Fréjus, lying about 1¼ mile to the south of the main summit of Mount Cenis—has an elevation of 9,376 feet above the sea; so that over the tunnel there is a mass of rock 5,281 feet—upwards of a mile—deep. The section of the mountain and tunnel is shown in the accompanying sketch. (Fig. 1.)

Fig. 1.

ROUGH SECTION OF THE MOUNT CENIS TUNNEL.

Col de Fréjus, 9,376 ft. above the Sea.



Level of the Sea.

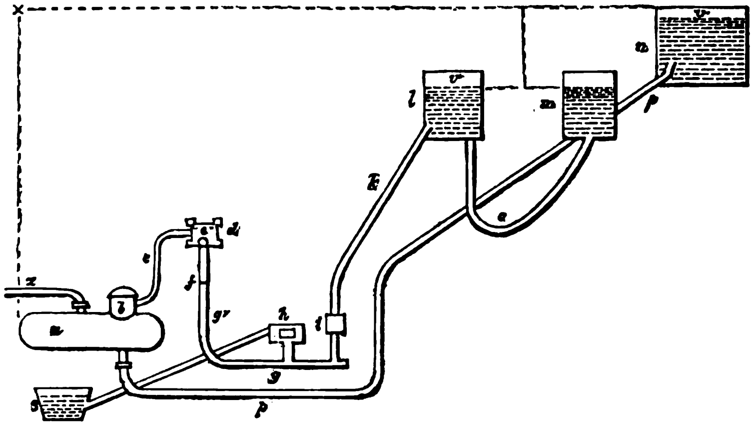
Air-Compressing Apparatus.

The work of tunnelling through this mountain is not carried out by ordinary hand-boring and blasting. The boring is accomplished by a machine moved by compressed air, which works simultaneously eight or ten borers, boring holes about 2 inches in diameter, which, having reached to the required depth, are charged and blasted in the ordinary manner. These borers, or perforators, are of cast steel, and are carried on a frame-work, 27 feet long, 6¾ feet high, and 5 feet wide, moved on ordinary rails with wheels 13 feet apart, which, when working, are fixed by a break and attached to the rails. Behind this frame is a second carriage, with a closed reservoir of water, 13 feet long, from which a continued stream of water is forced by a small air-pump into the holes to clean them out. The size of the preliminary level driven by this means is about 8 feet square. The rock, as far as yet seen, is principally a calcareous schist, frequently traversed by numerous quartz veins.

These borers are worked by compressed air, which is evidently

Fig. 2.

SKETCH OF AIR COMPRESSING APPARATUS.



the only motive power available. The accompanying sketch (Fig. 2) will show the principle upon which the air-compressing apparatus in use at the Bardonnèche end is constructed.

The apparatus, although for convenience shown near together in the sketch, really consists of two distinct portions—the reservoirs (*l*, *m*, *n*,) on the side of the mountain, and the compressing apparatus proper, which is in the valley near the mouth of the tunnel. The height of the reservoirs above the point *h* is about 85 feet, and the quantity of water available per minute with this pressure is about 60 cubic *mètres*, giving a theoretical force 333 HP, and a real force of about one-half this.

The reservoir *m* collects the waters of several mountain torrents in the neighbourhood of Bardonnèche, and communicates by the pipes *o* with the second reservoir *l*, which is furnished with all the necessary means for regulating the distribution of the water to the various compressing apparatus by the conduit pipes *k*. In *i* and *h* are two valves—that in *h* being of the double-beat form. By means of the valve *i*, the communication is opened or closed between *k* and *g*, and by means of *h* the water is allowed to escape by the pipe *r* into the basin *s* after having utilized its force in the receiver *a*. The atmospheric air enters into the vertical part *g*′ of the pipe *g* by the valve *f*, which opens inwards: at the summit of *g*′ is the valve *e*, placed in the piece *d*, which is connected by the pipe *o* with the dome *b* of the receiver *a*. This receiver, which is boiler-shaped, and is 30 feet long by 5½ feet in diameter, receives the compressed air, which is afterwards distributed by the pipe *z*.

In order to maintain the air at a constant pressure (5 atmospheres) in the receiver *a*, notwithstanding the quantity used to work the boring machines, the bottom of this receiver is placed by the pipe *p* in communication with an upper reservoir *n*, the level of the water in which can oscillate without waste. This reservoir is

165 feet above the level of the receiver, but it only requires replenishing at lengthened intervals.

The operation commences by compressing the air in the receiver by means of the reservoir *n*, so as to set in motion a small water-pressure engine which works the valves *i* and *h*.

In order to understand the action of the apparatus, let us suppose the pipes and spaces *i*, *h*, *g'*, *d*, *b*, as well as *a*, filled with air at the ordinary atmospheric pressure. Now, if the admission valve *i* is opened, the water rushes by the tube *k* from *l* towards *g'* pressing the air before it. The valve *f* closes while the valve *e* opens, and the air is driven and compressed into the receiver *a*. When the air has been compressed as much as possible by the column of water, the admission valve *i* closes, the valve *h* opens, and the water which had risen up to *f* escapes by *h* and *r* into the basin *s*.

During the escape of the water, the valve *e* closes, and the valve *f* opens by the atmospheric pressure to admit a fresh supply of atmospheric air into the pipe *g'*. When, in the next stroke, *i* is again opened, and *h* is closed, this air is again compressed and forced into the receiver.

The force of the water thus compresses more and more the air in the receivers, until after a certain number of strokes it acquires such a tension that the distribution pipe *z* must be opened or the machine stopped. When the compressed air is used for working the boring apparatus, it is necessary, in order to keep up an equal pressure, to put the bottom of the receiver *a* in connection with regulating reservoir *n* by means of the conduit pipe *p*.

There are ten air-compressing apparatus, such as we have described, at Bardonnèche placed side by side, from which ten distributing pipes *z* lead to the boring machines at the face of the tunnel. These distributing pipes are of wrought iron, 8 inches in diameter, $\frac{3}{8}$ths of an inch thick, each pipe being about $6\frac{1}{2}$ feet long. They are bolted together with india-rubber rings to secure their being air-tight.

On the Italian side, at Modane, there is no great fall of water available, so the air is compressed by air-pumps worked by ordinary waterwheels.

Notes on the Auriferous Mines and Deposits of the Spanish and Portuguese Estremaduras.

By H. W. Bristow, F.R.S., F.G.S.,

(Of the Geological Survey of Great Britain.)

(*Continued from page* 100.)

This great auriferous zone is not of equal richness throughout, since, in some localities, the banks of the rivers and the deposits near them are remarkably productive, while elsewhere they are much less so. It comprises two principal auriferous centres from eight to twelve leagues apart; one being situated in Spain, and the other on

Mount Hermoso, near the banks of the Alagon, in the province of Caceres. The latter, although the poorer of the two, has, nevertheless, yielded very good profits to the men who go there to search for gold by washing the coarse gravel in a rough way—an operation which is of a very laborious and unhealthy character. The former centre, or that which lies at the confluence of the Tagus and Eljas, offers much better prospects for exploration. There gold abounds on the hills as well as in the beds of the streams and in the bottom of the ravines; and it is a noteworthy fact, that after being continually found for so many ages, it is not only not exhausted, but it even seems to become more abundant every year. Quite recently nuggets of gold have been found, entirely free from matrix, of 2, 3, 7, and even of 18 ounces weight.

Without entering on a scientific discussion of the causes which have produced the richness of these deposits, we will only here state an undeniable fact, easy of proof, known to the natives and certified below, viz.,—the presence of considerable quantities of gold in the earth, revealed continually by local veins, and the abundance of this precious metal, either in nuggets or in scales, either adhering to the quartz ore matrix, or merely in its native state, which are met with sometimes associated with other minerals, such as argentiferous lead, ores of copper, &c.

The Portuguese villages of Rosmaninhal and Alares, adjacent to each other and bordering on Spain, are the possessors of these privileged deposits, the exploration of which presents a prospect the more favourable in consequence of their never having been worked. Moreover, the deeper they are worked the richer they become—since, belonging to the same formation and of the same geological age, composed of similar gravels, and the plough or the pickaxe never having penetrated them, they ought naturally to become more charged with gold in depth.

A report published on these same deposits by a person of experience, states:—"Of all the auriferous deposits with which I am acquainted, none present that metal either in such large quantities or of such good quality as those of Rosmaninhal and very few of them combine so many conditions favourable for working." (Le Minero, No. 449.) The mines of auriferous quartz already mentioned which were worked in 1792 by Alonso Beltran, in 1830 by Mons. Viri, and rediscovered in 1851, are all situated in the district, (terres) of Membrio in Spain and are close to the Tagus and the Salor, which rivers only divide the auriferous deposits here described.

The proprietors of these mines and auriferous deposits, which comprise an area of three or four square leagues, being desirous of establishing in an authentic manner the exactness of all these indications and accounts, have caused works of exploration and trial to be made, which have all afforded the most favourable results, and fully confirm the certainty of their richness.

The person charged with these operations, wrote:—"I have already commenced working on the banks of the mill of Las Vegas, by taking the earth of the Val de Encuerto, situated a hundred paces on the south-east side of the mill, and from each wooden bowl of this earth washed by us, who have no experience in this operation, we

obtain on an average from twelve to fifteen small pieces of gold, which I forward to you by Mateo Barbado, Rosmaninhal. Antonio Carreiro."

The same person states at a subsequent date :—" In prosecuting our researches we halted at the stream of the fountain del Corcho, in order to examine the same ground where, some days before, a shepherd had found, at first sight, 30 pieces of gold; but, as we were a little way from the water, and I had only one labourer with me, I gave up the experiment for the moment. I then began working on the banks of las Taliscas, south-east of the above-mentioned fountain, a little lower down than the spot where the thirty pieces of gold had been found. We there extracted gold in greater abundance than in any other place we had tried up to the present time, and I do not hesitate a moment to assure you a very great success for your enterprise. Rosmaninhal. The same."

On the 20th March, the same person wrote :—" We have had for some days rains, during which more than a pound weight of gold has been found on the surface, in large and small lumps."

Later, he states again :—" I send you a nugget of gold weighing 3½ ozs. 3 adarmes and 40 grains — perfectly pure and discovered within the last few days."

Some days afterwards he writes anew :—" I have collected for you more than half a pound weight of gold, which I will forward to you."

A still further proof, more worthy of credit, is afforded by the two following documents—the first emanating from the Mayor of the town of Rosmaninhal, and the other from the Governor of the Portuguese province in which the gold-bearing deposits are situated.

These documents are as follow :—

" Antonio Marques Lavade, Mayor of this town of Rosmaninhal, &c.

" I certify that it is true and known throughout the Kingdom of Portugal, that from time immemorial, notable quantities of gold are frequently found in large and small pieces, in the soil of certain parts of this town, and on the neighbouring mountains of Alares, and that to my own knowledge there was amongst them a piece weighing 18 ounces, others of 11 and 12 ounces, and several of 2 and 3 ounces, and that last winter one was found of 3½ ounces an eighth and 7 grains.

" I equally certify that, lately, another has been found more than 2 ounces in weight, and that fresh pieces are being daily discovered—and that to verify this fact, by demand of Antonio Dias Carreiro Pelote, of this town, I deliver to him the present certificate, which is invested with my signature.

" Rosmaninhal,
" *8th June*, 1856. " ANTONIO MARQUES LAVADE.'

The second document states :—

" Mons. the Governor of the Province of Castello Branco.

" Antonio Dias Carreiro Pelote, of the town of Rosmaninhal, council of Idanha à Nova of the same district, deposes to your Excellency, that, being engaged in forming abroad an influential company for working the rich auriferous deposits of Rosmaninhal and Mount Alares, on a large scale, it will be necessary for him to make a statement in a legal manner, of the great and numerous quantities of gold which have been found, and which are still frequently found, in large and small pieces in those deposits, simply at sight and without any kind of labour; and as it seems right to me that the certificate should emanate from the

first authority in the province, I entreat your Excellency to deign to certify according to my request.

"Rosmaninhal,
"25th *June*, 1856. "ANTONIO DIAS CARREIRO PELOTE.
"For the Procureur,—" JÔAA GOMEZ BICHO.
"The Secretary will certify to what he deposes,
"Civil Government of Castello Branco.
"The Civil Governor.—HARREI PINTO."

CERTIFICATE,

"Jôao Antonio da Silva, Bachelor, of the University of Coimbra, Commander of the Order of Christ, Secretary General to the Civil Government of the districts of Castello Branco.

"By virtue of the above order I certify it to be a circumstance generally known, and in presence of a document from the Administrator of the Council of Idanha Nova, which is in existence, to the Secretariat of that civil government, and which has reference to the object of which the present petition treats, that for all time numerous pieces of gold in a rough state have been found, and are now actually found on the surface of the deposits in the vicinity of Rosmaninhal, and without any kind of labour; and that it results from the above-mentioned document, that pieces of this metal have been found of remarkable size, and amongst others of a weight exceeding 16 ounces, and several others which have been procured quite recently of various sizes.

"And in proof of the truth of what is stated above, this certificate has been signed by me and sealed with the seal of this Civil Government of Castello Branco—5th July, 1856.

"JÔAO ANTONIO DA SILVA."

Resuming the subject, and taking into consideration the various accounts and circumstances above-mentioned, we should naturally desire to see this ancient prosperity resuscitated, for its elements exist now as in the palmiest days of its greatest opulence. But, at the same time, it is absolutely necessary that this enterprise, in order to yield the results which it promises, should be established with sufficient capital:—

1st. To be able to obtain new and powerful machinery, lately invented for stamping and washing the auriferous quartz.

2nd. Those useful for the daily washing of large quantities of gravel.

3rd. For the erection of buildings necessary for the management of the undertakings and for those indispensable for the concentration and amalgamation of the gold dust.

4th. To secure the services of an experienced engineer.

5th. To obtain experienced workmen, &c.

All these conditions are necessary to insure the prosperity of this great operation.

The Condensation of Lead Fumes.

By Armand Fallize, Civil Engineer.*

The means used for condensing the products carried away in fumes during the metallurgical treatment of lead ores are generally very simple. On the Continent lead smelters are usually content to place their works near a steep hill, on the side of which they build their chimney, with which the furnaces are connected by a long zig-zag vaulted flue. The great draught caused by such a position allows of the employment of turns and zig-zags, which by the amount of surface friction they present more or less completely condense the fumes. This simple arrangement is well enough when the situation of the works is such as to admit of it.

Frequently, however, and particularly in England, the condensation is obliged to be effected in a much smaller space, and is pushed much further. Large chambers are employed in which the fumes are made to circulate about variously arranged condensing surfaces, the operation being at the same time aided by a constant shower of cold water, sufficient to precipitate the matters condensed by the contact surfaces. Any required intensity can be given to the draft by mechanical exhausting appliances. By such energetic means the proportion of valuable products condensed in English works is very different from that of continental works, and this is probably one of the causes of their greater relative prosperity.

The most usual English form of condenser consists essentially of a chamber divided into compartments by a considerable number of vertical partitions, open alternately at the top and bottom, through which the fumes are forced to pass up and down—a shower of cold water being kept falling from the roof of those compartments in which the fumes descend. In some forms of condensers the water in the bottom of the chamber is allowed to rise slightly above the edge of the opening below the partition, so that the fumes have to force down the surface of the water, and be drawn through it, in order to continue their course into the next compartment; by this means they are brought into close contact with the water, which is so favourable for the condensation of lead fumes, but a very powerful exhausting force is required to keep up the current. In another form the chamber is also divided by a horizontal framing, on which beds of coke or other filtering matters are arranged, through which the fumes pass. The slimes resulting from the condensation of the fumes in the water are, in either case, withdrawn periodically from the chambers.

Importance of Condensation.—In order to appreciate the importance which should be attached to the attainment of as complete a condensation as possible of lead fumes, it is necessary to consider the value of the products carried off in the course of the smelting of that metal.

If we treat a galena of medium produce, which would yield 70 per

* Abstracted from the *Revue Universelle*.

cent. of lead, by the ordinary dry assay, we find that, in the best conducted works, the ultimate returns will not exceed 63 per cent.—that is to say, there will be a loss of nearly 1½ cwt. per ton of ore treated.

The special loss by volatilization is, in a reverberatory furnace, at least 150 lbs., and in a blast furnace 130 lbs. Taking the value of lead at 20*l*. per ton, it follows that the value of the lead sublimed in treating 1 ton of galena will be 27*s*. in the former case, and 24*s*. in the latter. Therefore, in smelting works, without condensing-flues, working one furnace of each description, treating 8 tons of galena per day of 70 per cent. produce, there would be an annual waste in fumes of 3,500*l*. In the case of ores of a less percentage—say 50 per cent.—the proportionate loss would be still greater.*

Experiment shows that dry condensation in long flues, although so advantageous from its inexpensiveness, can really do little more than palliate this great waste, for the proportion of the lead originally volatilized which is retained by them rarely exceeds a quarter of the whole quantity. It consequently becomes a serious consideration whether it is not advisable, rather than submit to such a loss, for smelters to incur the expense of efficient condensers. The question is one of great importance, a consideration of which has led to the suggestion of the following

New form of Condenser.

In this form, in which an endeavour has been made to combine the most simple systems of condensation with those in use in England, the principle consists in injecting a jet of steam into the passage through which the fumes pass from the furnaces. The steam is injected in such a quantity that every part of the gaseous current is impregnated with it; and being subsequently condensed, each molecule of water formed by this condensation catches and throws down the condensable particle of the fumes corresponding with it. These points of contact being multiplied *ad infinitum* the condensation is rendered as complete as possible.

Description of the Apparatus.—The apparatus, which is shown in Plate I, consists of two chambers A and B, the bottoms of which are kept covered by a determined height of water, maintained constant at the level $x-y$.

The fumes enter the chamber A by the extremity E of the flue leading from the furnaces, and pass longitudinally towards the elbow C by which they enter the chamber B. Two jets of steam are injected by the orifices *b b*.

On arriving in the chamber B, the gases are thus perfectly saturated with steam; and are besides to some extent cooled, partly by the steam, partly by the contact with the constantly renewed water in the bottom of the chambers, and partly by the expansion which results from the difference in the sections of the two chambers.

* Although all lead ores contain a greater or less proportion of silver, it is remarkable that the volatilized fumes carry off but a very small proportion of the precious metal.

The middle of this chamber B is barred by two vertical intersticed walls *m m*, in the space between which are placed sets of hollow perforated balls similar to those used in the condensation of hydrochloric acid. Above this is the basin H, from the perforated bottom of which a shower of cold water falls, which spreads over the surface and the interior of the balls.

In traversing the interstices of these balls, the gases are cooled; the steam condenses; and the water thus formed, added to the shower of cold water from above, carries to the bottom of the apparatus all the condensable products—whether soluble or insoluble—held in suspension in the fumes.

The insoluble matters, and particularly the plombiferous products, pass through the stratum of cold water and fall on the inclined bottom which carries them towards the longitudinal channel K K, where they collect. From this the condensed matters are easily withdrawn, the bottom part N of the channel being arranged in the form of an inclined plane, up which they can be drawn and left to drain.

Any solid particles carried by the current beyond the channel K K are caught in the partitioned pit L L, which the liquid traverses before being discharged.

On the other hand, all matters condensed in the chamber A, or in the chamber B outside the intersticed walls described, are equally brought into the channel K K, for which purpose the walls separating the chambers A and B are supported by the vaulting V V which is kept constantly submerged.

Another powerful jet of steam is injected by the orifice *b′* into the current of vapour on leaving the apparatus in order to restore some of its original intensity to the draught.

A manometer placed in a convenient part of the channel shows the interior depression, by which the flow of the water into the chambers should be regulated, so that the condensation may take place under conditions the least unfavourable to the draught.

It is evidently indispensable that the apparatus should be placed at such a distance from the furnaces that the gases may be sufficiently cooled that their temperature shall not prevent the condensation of the injected steam.

As the condensation, in ordinary flues, depends in a great measure on the extent of the exhaustion as well as on the amount of friction surface presented, it is well to employ apparatus as large as possible, and so arranged besides as to multiply the points with which the fumes will have to come in contact. With the latter object it is well to adopt a series of parallel partitions which will divide the fumes into as many distinct parts; these partitions may be best and cheapest constructed with perforated bricks cemented together with plaster, half a brick thick.

In every case the materials employed should be such as are not easily injured by the acid gases, for the products of sulphuretted ores must evidently produce some quantity of sulphuric acid. This is easily attained by using bricks made partly of clay and partly of coke, and of employing lead where required.

In the instances of obstruction in the interstices of the condensing balls, it will generally suffice to increase the shower of water; but in extreme cases a jet of water from a force pump on the face of the walls will be found effectual.

It remains only to consider the case where the proportion of smoke would be so great as to cover the surface of the water in the chamber with such a quantity of fine soot as to prevent a contact between the water and the fumes. This can be remedied by building the arches of the vaulting so that their summit may be emerged by a slight fall in the level of the water: the latter is effected by checking the flow of the current until the impurities are removed. In actual working, however, this rarely occurs.

Advantages of the proposed system.—Let us now inquire the advantages of the proposed system compared with those usually employed.

Independently of its mediocre results, the common mode of dry condensation in long flues has many inconveniences.

In the first place, an enormous development must be given to the flues; and as the section diminishes in proportion as the deposits are formed, it follows that the velocity of the current augments continually during the working. The working has besides to be interrupted during a sufficient time to allow of the cooling of the walls and the removal of the condensed matters: the latter also, under this system of condensation, necessarily contain many impurities injurious to their ulterior treatment.

The first advantage of the proposed apparatus consists in its small cost, which need not exceed 200*l.* for a medium-sized works.

The cost of steam need not be considered, for most works usually possess engines whose waste steam may be employed with the greater convenience, as the temperature, not being great, it will be condensed with a small quantity of water.

The cost of labour is insignificant, since the operations go on by themselves, and all that is required is to withdraw, from time to time, the condensed products. The lead fumes collected are besides very pure, because the water carries off all the acids and soluble salts, as well as the carbonaceous matters.

The only special cost of any importance is that which requires the maintenance of the water at a certain level in the chambers and in the basins above—an expense which will not exceed the cost of working a pump of 2 or 3 H P.

With these negative advantages it also possesses eminently all the conditions required for perfect condensation, in the following particulars:—

1. *A small velocity.*—The gaseous currents, saturated with water, *débouche* into a large-sectioned chamber.

2. *Cooling.*—The gases, impregnated in the first place with steam cooler than themselves, expand on entering the apparatus; they are besides brought into contact with a liquid bath, and are lastly watered by a shower of cold water.

3. *Friction.*—The parallel partitions in the line of the current present an enormous contact surface.

Lastly, the application of the principle upon which the operation

is essentially founded, which consists in condensing the steam in the very current itself, must, above all, cause the most energetic condensation of the fumes.

When the apparatus is in work, its action can at any time be stimulated or moderated as the requirements of the draught of the furnace may need. To effect this, it suffices to modify the quantities of water and steam injected.

Illustrated Notes on Prominent Mines.

By the Editor.

Pedn-an-drea Mine.

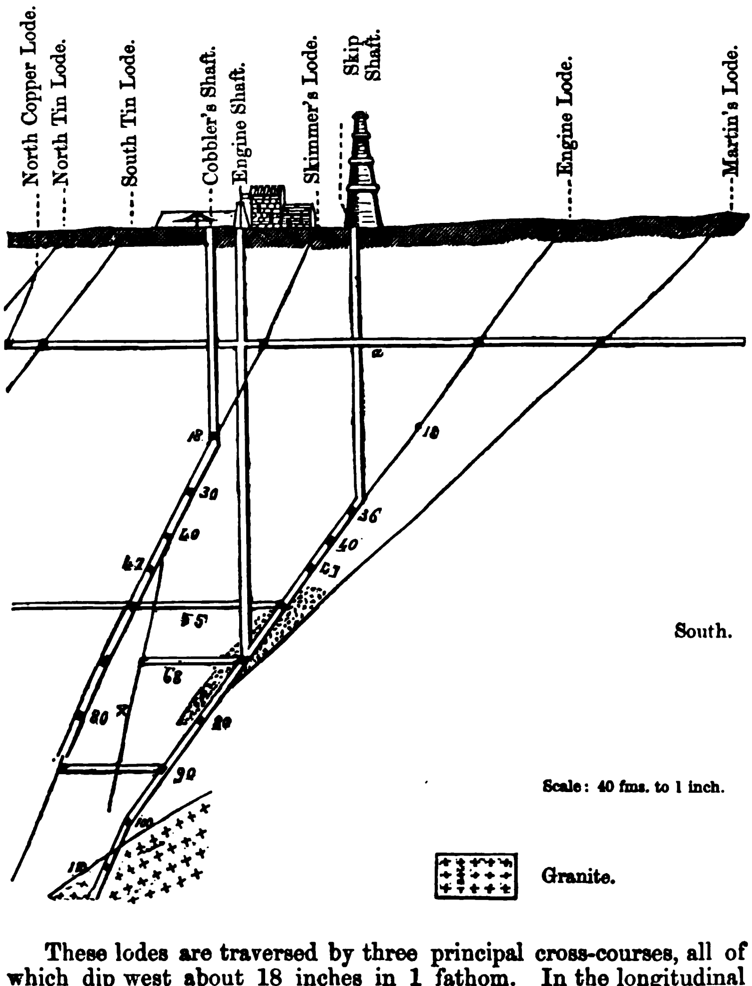
Pedn-an-drea is situated at the eastern end of the town of Redruth, Cornwall, under which the workings extend. It is an ancient mine, having been explored in a former working, many years since, to the depth of 69 fathoms under adit; but the present working is only recent, and as yet has failed to yield any profit, although the returns now reach 20 tons of tin per month.

But although Pedn-an-drea is neither remarkable for riches, nor for being selected by jobbers as a medium of speculation, it is an interesting and, in some senses, an important mine. The great deposit of tin which was made between the 55 and the 68—and which although discovered and principally worked away in the ancient workings is not yet entirely exhausted—was one of the most remarkable, and indeed typical, ever met with in Cornwall; while the present explorations in the bottom of the mine are important to the whole district, as they will decide whether or not we may expect similar deep tin mines in the Carn Marth granite boss as have been met with in the Carn Brea boss to the west. For these reasons I have thought Pedn-an-drea worth describing, although it does not happen to be either rich or notorious.

There are two principal lodes at present in course of working —the engine lode (formerly called Suit and Cloak lode), and Skimmer's lode, both of which underlie north, as shown in the accompanying transverse section, (Fig. 1). Above the 68 the Engine lode divides, and Martin's lode goes off to the south with a greater underlie; while below the 47, Skimmer's lode divides, sending off a southern branch (marked ×) more vertical. Besides these, to the north are the three lodes marked in the section as the South tin lode, the North tin lode, and the North copper lode—none of which, however, are in work at present.

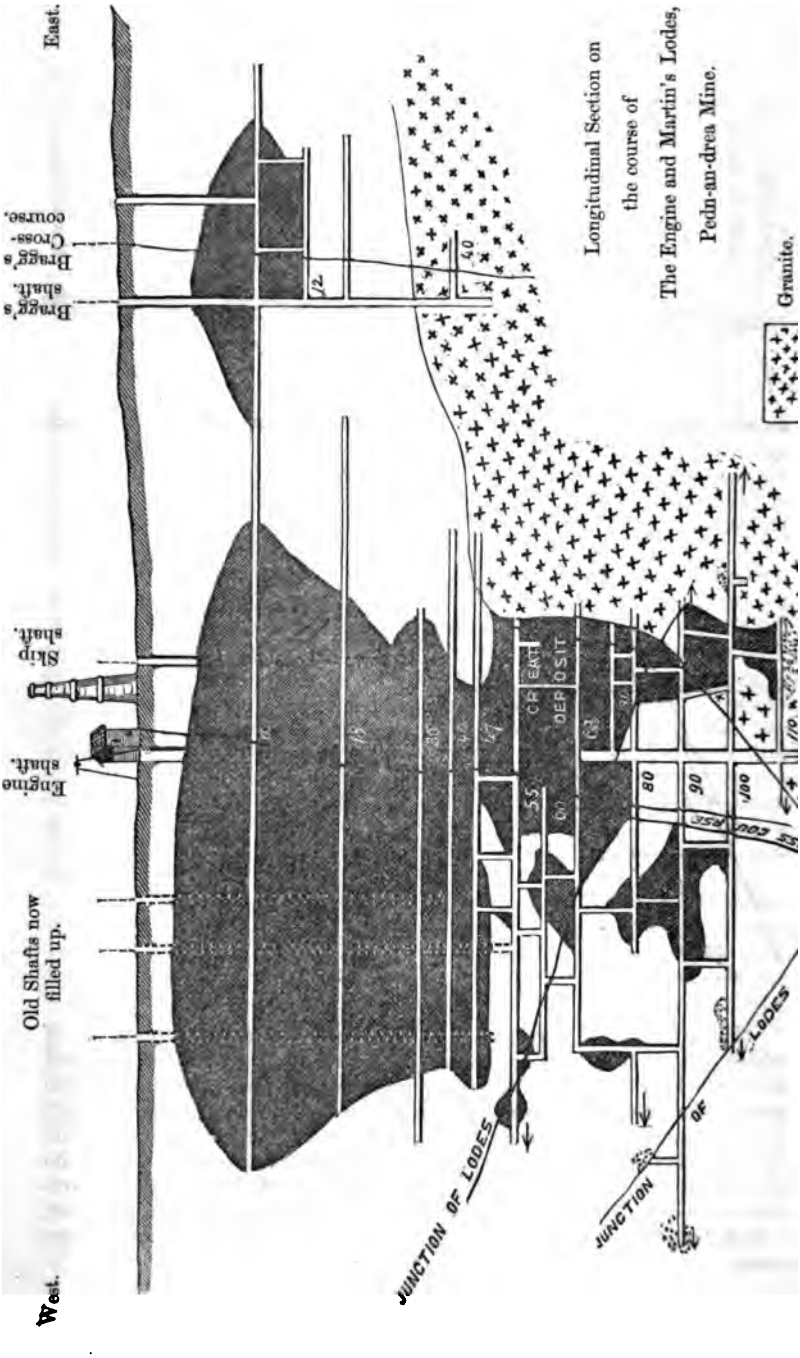
Fig. 1.

TRANSVERSE SECTION AT PEDN-AN-DREA.



These lodes are traversed by three principal cross-courses, all of which dip west about 18 inches in 1 fathom. In the longitudinal section (Fig. 2) on the following page two of these are shown—the great cross-course, passing through the engine shaft, and Bragg's cross-course in the eastern part of the mine. Another, called the Western cross-course, also traverses the lodes, but too far west to be shown in the section. In Wheal Sparnon, further south, a considerable quantity of cobalt was raised on this western cross-course, which for some years was worked for that ore: like the others it dips west.

Fig. 2.


East.
Bragg's Cross-course.
Bragg's shaft.
Skip shaft.
Engine shaft.
Old Shafts now filled up.
West.
GREAT DEPOSIT
JUNCTION OF LODES
JUNCTION OF LODES
Longitudinal Section on the course of The Engine and Martin's Lodes, Pedn-an-drea Mine.
Granite.

The Engine and Martin's lodes seem, from grass, to have been almost entirely tin lodes. From near the surface down to below the 47 the whole of the ground on the engine lode has been worked away for a length of between 100 and 150 fathoms, but we have no information as to its richness. Between the 47 and the 55 the old men found a rich piece of ground west of the engine shaft; but it was below this, between the Great cross-course and the vertical face of granite, that the great deposit of tin was met with, extending downwards from a little below the 50 to the point of junction of the Engine and Martin's lode, being the upper junction of lodes marked in the section, Fig. 2. The deposit made largest, longest, and richest about the 68, from which level it was principally worked upwards.

This great deposit—which in the old working was, I believe, named the great Carbona—is what the Germans would call a *Stockwerk*, a kind of formation for which it is rather odd we have no special name in our mining language. For a length of 25 fathoms at the 68, the tin made in branches in the killas "country" by the side of the lode, for 11 fathoms wide—the lode itself being only 4 feet wide. The richest part seems to have made about this level to the south of the Engine lode, between it and Martin's lode: the position of this formation, with regard to these lodes, is shown by the dotted portions in the transverse section, Fig. 1.

I consider this great deposit as eminently characteristic of a class of stanniferous formations common enough in Cornwall, but which are usually classed as "lodes." I do not mean to say that they are improperly so classed, for I should consider that any metalliferous channel of ground with a definite direction and dip might properly be called a "lode"; but the word has received a theoretical meaning, implying exclusively a mineral deposit between the walls of an original fissure, which many of the richest stanniferous deposits in Cornwall called lodes certainly are not. Indeed, much of the misconception which prevails between geologists and miners on the phenomena of metalliferous veins is probably due to a misunderstanding as to facts and definitions. A miner speaks of a lode of such and such a width with north and south walls, and the geologist at once declares that this whole width must have been originally an open fissure. This the miner refuses to believe, maintaining—rightly enough—that such a fissure could not have remained open any considerable length of time. The real fact is that there was a fissure, but often only a very small one, from which a metamorphosing and replacing action appears to have emanated, extending to a greater or less distance, metamorphosing the neighbouring rock into a "capel" and impregnating it, by replacement, with oxide of tin. Where this is confined to a moderate width, and where the tin does not extend away in veins at right angles to the lode, the miner classes it all as "lode"—and properly so. As to "walls," which some appear to consider the criterion of a true lode, they may, in these highly dislocated districts, be frequently met with *ad infinitum;* and in such deposits as those referred to it is not unusual to find that half-a-dozen "walls" have been adopted in succession as the true wall of the lode, and abandoned. Nothing is more common

than to be told that on cutting into what was taken for the wall "more lode was found standing;" and in these classes of deposits the face ultimately adopted as the "wall of the lode" is that face beyond which the ground will not pay to be taken away.

I do not, of course, wish to imply by this that there are not many lodes wholly confined within the walls of an original fissure—lodes in the popular geological sense. I only wish to point out that there are many lodes of a different character; and this Pedn-an-drea deposit is characteristic and worthy of study as forming a link between lodes of this class and those still more irregular deposits of tin ore called Carbonas in the extreme western districts of Cornwall.

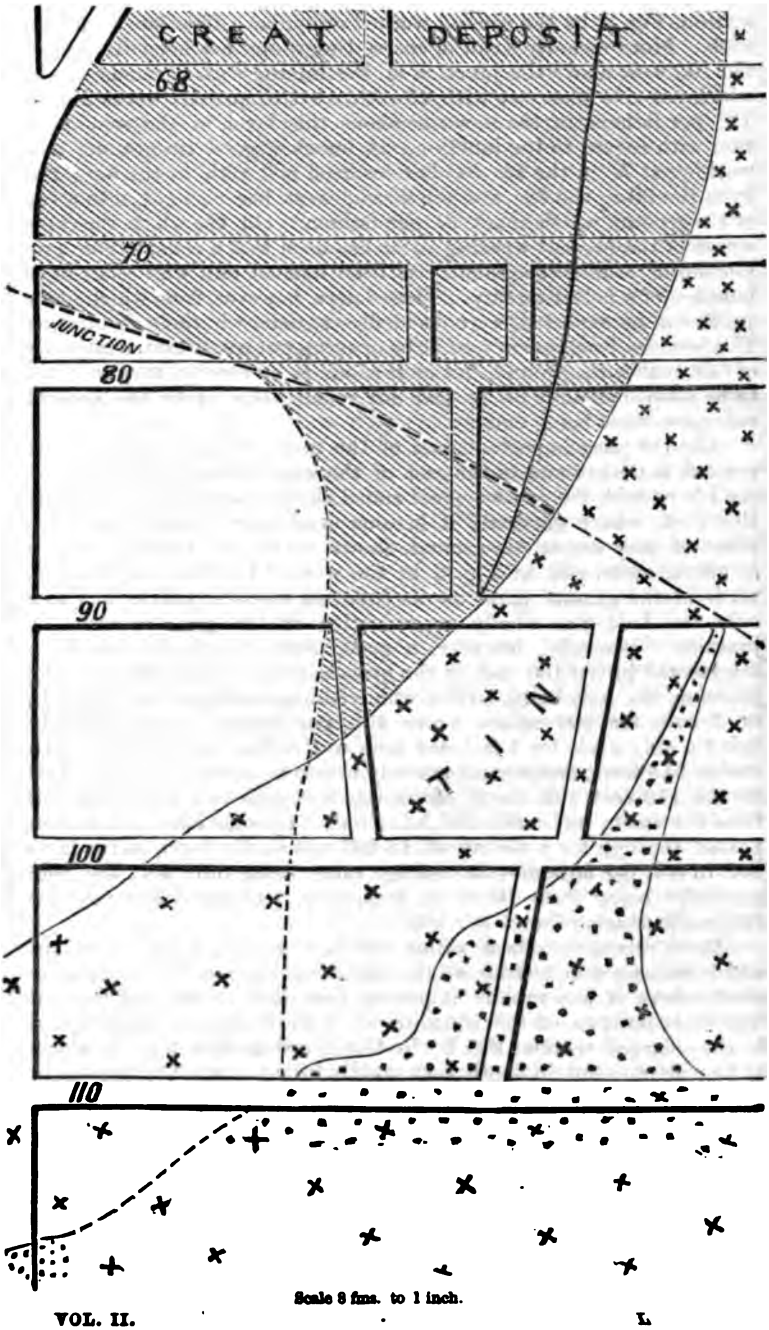
I have said that the original working was pursued to the depth of 69 fathoms on the Engine lode. Here the lode in the engine shaft became poor, and the whole operations of the mine were concentrated on the working of the great deposit, between the shaft and the face of the granite. The exact manner in which this deposit made is shown in the accompanying section on the course of the lode, Fig. 3, on the scale of 8 fathoms to 1 inch; the shaded part between the shaft and the granite showing its extent, and the wedge-like form in which it came to an end; although it must be understood that it was not equally rich all through this space, for, while it extended, as already stated, to a width of 11 fathoms at the 68, it never exceeded 6 fathoms wide at the 80, or more than 4 fathoms at the 90.

The limits of this deposit in depth was the junction of the engine and Martin's lode, which is shown by the dotted line, lettered "junction," in the section. The dip of this junction continued regularly through the mine, as shown by Fig. 2, to a point in the 80 fathom level a little east of the shaft, after which there seems to be two junctions—one following down in the regular run, and the other going down perpendicular to the 110. What lode it is that causes this downright junction is not at all clear; but, whatever it may be, the tin continued to make over (or rather to the east of) the downright junction to its contact with the granite, by which, all the way up, the tin is cut off. With regard to this granite junction, it is remarkable that its face is thrown some way back by contact with the lode and its stanniferous neighbouring rock, between the 55 and the 90: the face of the granite in the country follows the western line shown in the sections.

During the present working it will be seen that the mine has been sunk from the 69 to a point 8 fathoms below the 110. At the 80 and 90 east, the lower wedge end of the great deposit was explored and worked away; unfortunately, however, it was not very long in these levels. Great quantities of tin have also been raised from the old workings on the great deposit by cutting further into the walls; indeed this part of the mine, above the 68, has returned as much as 7 tons of tin per month. Even at the present moment it is returning about 2 tons of tin a month; and as an instance of the almost inexhaustible nature of such wide deposits, in hard ground, one pitch has been working by the same pair of men for upwards of seven years.

West of the shaft a rich bunch of tin was also discovered, during

Fig. 3.



Scale 8 fms. to 1 inch.

the present working, above the junction of the Engine and Martin's lodes; and several other pieces of coarse tin ground, marked in the section, Fig. 2, by the ground worked away, have likewise been met with. More recently a run of coarse tin-ground has been discovered, the 100 west above the junction of the Engine with Skimmer's lode, which has also been met with, of rather better quality, worth 10*l.* to 12*l.* per fathom, in the new rise above this level, in the same position with regard to the junction. A bunch of good tin-ground, now working at 7*s.* in the 1*l.*, has besides been met with in the long rise from the 90 to the 68; and the 90 end west has also got into a run of tin-ground, worth about 6*l.* per fathom. On the whole the experience of the present working so far has been that a considerable proportion of coarse tin-ground has been opened out, with occasional bunches of a better quality. These latter, however, from which alone profit can be expected, were decidedly capricious in their occurrence. The western levels seem now to be opening out a substantial quantity of fair quality tin-ground, but as the lode is so bunchy they required to be pushed steadily on to give any result; this under the present management is being done.

But the most important part of the mine on the Engine lode at present is that in and to the east of the engine shaft in the granite. As I have said, the great deposit ended abruptly on the lode entering this rock, where generally it became dead poor. Below the 90 a piece of very coarse tin-ground, shown in Fig. 2 by being marked as taken away, and in Fig. 3 by the word "TIN" in the Section, made in the granite close on its junction with the killas; but as a rule the lode was wholly unproductive in the granite near the junction. Recently, however, a good piece of ground has been intersected in the 100 east, in the granite, about 17 fathoms from the junction, the lode being 10 feet wide yielding work producing 2 cwt., or 5 cwt. for 100 sacks, worth 40*l.* per fathom. Unfortunately this tin only made for 4 fathoms long in this level, and went up in a wedge-like form, cutting out entirely before it came to the 90. But in the 110 east, this shoot of tin was met with only 11 fathoms off from the shaft; and instead of being only 4 fathoms long, it has been passed through for a length of 18 fathoms in this level, worth from 20*l.* to 60*l.* per fathom—the average value being fully 40*l.*, the lode generally being from 10 to 12 feet wide, yielding 300 sacks per fathom, producing 5 cwt. per 100.

More recently, indeed within the last month, a course of tin which seems a continuation of this shoot has been cut in the engine shaft, where it has rapidly improved from 20*l.* to 60*l.* per fathom. The exact position of this shoot of tin is shown by the dotted space in the enlarged section, Fig. 3: by this it will be seen that it seems to be widening out in depth very rapidly from the point of the wedge just under the 90—its eastern limits dipping with the face of the granite at a distance of from 10 to 12 fathoms. It may be worth remark, that in the new shoot in the 110 the tin made to the north of the lode near the shaft, to the south of the lode further west, and to the south of the lode in the shaft. It would almost appear that as the great deposit of tin *above the granite* ended in a wedge-like form downwards, so this new shoot *in the granite* (beginning where the

other terminated) ends in a wedge upwards and opens out downwards. If this should turn out to be the case, Pedn-an-drea may turn out, after all, a great and profitable mine.

In the great run of lodes at the foot of Carn Brea granite, of which the Pedn-an-drea lodes are an eastern extension, the lodes make tin both in the killas and granite, but particularly in the latter rock. But there are many instances in Cornwall of tin making in the one rock and not in the other. Thus at Wheal Vor the lodes made rich in killas, but became unproductive in the granite of Tregonning Hill; while at Great Work other parallel lodes, made rich in granite of Godolphin Hill, became wholly unproductive in the killas. The granite with which the Pedn-an-drea lodes come in contact is that of the Carn Marth boss, in which we have not, as yet, any experience of a lode making tin in depth. The sudden impoverishment of the lode on coming in contact with this granite was consequently disheartening, and led many to the conclusion that the granite of the Carn Marth boss acted on the Pedn-an-drea lodes, like that of Tregonning Hill on the Wheal Vor lodes—that is permanently impoverished them. An idea of this kind—and a very natural idea in its way—has weighed upon the mine for many years, although it possessed no other foundation than the fact of the lode having become impoverished: for the composition of the granite rock was not of an unfavourable character for the production of metalliferous deposits. The discovery in the 100, 110, and the Engine shaft seems likely, however, to show that this idea, like many others prevalent respecting metallic mining, was too speedy a generalization from insufficient data.

Nothing is doing on the Engine or Martin's lodes in the eastern part of the mine. The 100 east is now being driven towards Bragg's cross-course, to which the end is now within 35 fathoms. When this level gets up to the cross-course, a cross-cut will be driven to intersect all the lodes, which will be a capital trial.

Skimmer's lode is also being worked to a considerable extent. The principal operations on this lode are from Cobbler's shaft, which is from 30 to 40 fathoms west of the parallel of the Engine shaft, and is sunk perpendicular to the 18, below which it goes down on the underlie of Skimmer's lode to the present bottom, which is 7 fathoms below 80, now sinking in a lode worth about 10*l.* per fathom for the length of the shaft. This shaft will be sunk to the 90, when that level will be driven back east to meet the 90 west, which is being driven on Skimmer's lode from a cross-cut to it from the Engine lode. There are only about 10 fathoms of ground to be driven here to communicate, which will be an important object effected for the ventilation of this part of the mine.

Skimmer's is not so decidedly a tin lode as the Engine lode, and, indeed, in the old working seems to have been classed as a copper lode. It contains a great quantity of fluor spar, and the tin-work it turns out is of a very low and coarse quality. About Cobbler's shaft there is a considerable proportion of jack also in the lode, and some of the pitches and ends are producing copper as well as the coarse tin stuff.

In the eastern part of the mine, in the granite about Bragg's

shaft and Bragg's cross-course, there are two ends now driving on this lode, the 40 and the 47 east; the former being about 40 fathoms ahead of the latter. The 40 end is now split up into branches, but this level has gone through a large gozzan lode for some length, which has produced good work for tin. The 47 is being driven up to come under this run of gozzan, but is poor as yet. These ends are being driven by two men each.

In the Pedn-an-drea sett, the old Wheal Sparnon Mine is included, and it is on this part of the sett, as being farthest removed from the town, that the stamps and dressing floors are placed. Wheal Sparnon is on the same run of lodes as those working in East Carn Brea, and it is generally believed that the East Carn Brea South lode is whole in this ground. However this may be, there are certainly some lodes in Sparnon ground which have not been worked below adit, and as these, whether any of them be the East Carn Brea South lode or not, are strong and promising as seen in the adit, this ground is undoubtedly an excellent speculation. It is now about being worked, as the adits are being cleared out and an engine purchased.

In the old Wheel Sparnon Mine the copper ore made above a large elvan course which traverses the sett, the same as met with in East Carn Brea and Wheal Union. Under this elvan the lode has not been tried. It has often been proposed to make this trial, and now no doubt it will be made, although the main object of the new working will probably be to explore the virgin lodes.

The last working of Wheal Sparnon was, however, not for copper, but for Cobalt, which was found in some considerable quantities in the cross-course already referred to, and which was called the Cobalt lode, just as the silver-producing cross-course now working in Wheal Ludcott is called the silver lode. The working on this cross-course was principally at 32, 40, 45, 50, 60, and 70 fathom levels. Although the quantity of this ore returned was considerable, the workings ended in a loss, as is generally the case with all these unusual ores.

The re-working of Sparnon will to some extent ease the water at Pedn-an-drea, to which a considerable stream now comes back from the former mine at the 55.

The general low quality of the tin stuff raised at this mine is shown by the following return of the monthly produce for the last seven months, estimated on the basis of 12 tons to the 100 sacks:—

	Per ton.		Per ton.
January..	21 lbs.	June	30¾ lbs.
February	23½ „	July	23½ „
March	18¼ „		—
April	28 „	Average of 7 months ..	22¾ „
May	21 „		—

Abstracts and Reviews.

THE *REVUE UNIVERSELLE.*

Revue Universelle des Mines, de la Metallurgie, de Travaux Publics, des Sciences et des Arts, appliqués à l'Industrie, sous la direction de M. Ch. de Cuyper, Professeur Ordinaire à la Faculté des Sciences de l'Université de Liége. Sixth year, 3rd livraison, May and June, 1862. Paris and Liége, E. Noblet, à Paris, rue Jacob, No. 20.

THE present *livraison* of the *Revue Universelle* contains many articles of more than ordinary interest. The leading papers are:

1. Condensation des fumées plombeuses, par Armand Fallize, ingénieur civil.
2. Fours et fourneaux comparés, par P. Havrez, ingénieur des mines.
3. Théorie de la trempe (*suite*), par C. E. Jullien, ingénieur.
4. Appareil pour alimenter les tenders des locomotives, pendent que le train est en marche, par J. Ramsbottom.
5. Sur un nouveau système de fours à coke, appliqué au menu charbon du Staffordshire, par A. B. Cochrane.
6. Revue économique, administrative et juridique des mines et de la métallurgie françaises, par L. Simonin, ingénieur civil des mines.
7. Revue semestrielle des travaux d'exploitation des mines de métallurgie et de construction, par E. Grateau, ingénieur civil des mines.
8. Bulletin.
9. Bibliographie.

M. Fallize's paper on the Condensation of Lead Fumes we have abstracted. M. Havrez's paper is a most able one, and enters on a field of inquiry which has unaccountably been neglected by writers on metallurgy in general—that is the general principles to be kept in view in the construction of furnaces of what kind soever.

We have before expressed our opinion of the value of M. Simonin's Review, and the one in the present number fully maintains its general reputation. M. Grateau's Review contains a mass of information not easily found in any other place. Among the topics of particular interest discussed by him are:—the formation of gold veins, in which he quotes from Mr. J. A. Phillip's paper in our *Magazine;* M. Lisbet's new boring machine; puddling by machinery, and puddling sulphuretted iron-ores; and Mr. Binks's studies on the composition of steel.

THE *ANNALES DES MINES.*

Annales des Mines, ou Recueil de Mémoires sur l'Exploitation des Mines, et sur les Sciences et les Arts qui s'y rapportent. Rédigées par les Ingénieurs des Mines, et publiées sous l'Autorisation du Ministre des Travaux Publics. Sixième Série. Tome I, 1862. Paris: Dunod, Quai des Augustins.

The second *livraison* of the *Annales des Mines* for 1862 contains the following memoirs:—

1. Mode de fusion de l'acier dans un four à réverbère. Procedé de M. Sudre. Rapport succinct sur les essais fait aux forges de Montataire par ordre de S. M. l'Empereur: Présenté à S. M. par MM. *Treuille de Beaulieu, Sainte Claire-Deville,* et *Caron.*
2. Memoir sur la fusion de l'acier au four à réverbère; par *M. Sudre.*
3. Etat présent de la métallurgie du fer en Angleterre; par *MM. Gruner* et *Lan.* (*Suite.*)

In reply to several correspondents we beg to state that our abstract of MM. Gruner and Lan's memoirs is in preparation, and will appear in an early number. It is no trifling matter to condense such an exhaustive and elaborate a series of papers into anything like a moderate compass.

ON THE PROPERTIES OF IRON, AND ITS RESISTANCE TO PROJECTILES AT HIGH VELOCITIES.

By William Fairbairn, F.R.S.

(Abstracted from a Paper delivered before the Royal Institution.)

We have no correct record as to the exact time when wrought-iron plates were first employed for the purpose of building vessels. It is, however, certain that iron barges were in use on canals at the close of the last century. In 1824, Mr. Manley, of Staffordshire, built an iron steamboat for the navigation of the Seine, and this was the first iron vessel that attempted a sea voyage. She was navigated from this country to Havre, by the late Admiral Sir Charles Napier, and although constructed for shallow rivers, she nevertheless crossed the channel in perfect safety. From that time to 1830, no attempt was made to build iron vessels, and nothing was done towards ascertaining the properties of iron as a material for shipbuilding.

A series of experiments, instituted by the Forth and Clyde Canal Company in 1829-30, to ascertain the law of traction of light boats at high velocities on canals, led to the application of iron for the construction of vessels; and the lightness of these new vessels, combined with their increased strength, suggested the extended application of the material in the construction of vessels of much larger dimensions, and ultimately to those of the largest class, both in the war and mercantile navy. Considerable difficulty, however, existed with regard to the navy; and, although the principle of iron construction as applied to merchant vessels and packets was fully established, it was nevertheless considered inapplicable, until of late years, for ships of war. It is true that until the new system of casing the sides of vessels, first introduced by the Emperor of the French, in 1854, was established, the iron ship was even more dangerous under fire than one built entirely of wood. Now, however, that thick iron plates are found sufficiently strong, under ordinary circumstances, to resist the action of guns not exceeding 120-pounders, for a considerable length of time, the state of the navy and the minds of our naval officers have entirely changed. We must, therefore, now look to new conditions, new materials, and an entirely new construction, if we are to retain our superiority as *mistress of the seas*. There yet remain amongst us those who contend for the wooden walls, but they are no longer applicable to the wants of the State; and I am clearly of opinion that we cannot afford to trifle with so important a branch of the public service as to fall behind any nation, however powerful and efficient they may be in naval construction. Having satisfied ourselves that this desideratum must be attained, at whatever cost, I shall now endeavour to point out such facts as in my opinion relate to the changes that are now before us, and simply endeavour to show—

1st. The description of iron best calculated to secure strength and durability in the construction of ships of war.

2nd. The distribution and best forms of construction to attain this object; and

Lastly, The properties of iron best calculated to resist the penetration of shot at high velocities.

Properties of Iron.—If we are desirous to attain perfection in mechanical, architectural, or shipbuilding construction, it is essential that the engineer or architect should make himself thoroughly acquainted with the properties of the materials which he employs. It is unimportant whether the construction be a house, a ship, or a bridge. We must possess correct ideas of the strength, proportion, and combination of the parts, before we can arrive at satisfactory results; and to effect these objects the

naval architect should be conversant with the following facts relating to the resisting powers of malleable and rolled iron to a tensile strain.

The resistance in tons per square inch of—

Yorkshire	24·50 tons.
Derbyshire	20·25 „
Shropshire	22·50 „
Staffordshire	20·00 „

STRENGTH OF RIVETED JOINTS.—The architect having fortified himself with the above facts, will be better able to carry out a judicious distribution of the frames, ribs, and plates of an iron ship, so as to meet the various strains to which it may be subjected, and ultimately to arrive at a distribution where the whole in combination presents uniformity of resistance to repeated strains, and the various changes it has to encounter in actual service.

There is, however, another circumstance, of deep importance to the naval architect, which should on no account be lost sight of, and that is, the comparative values of the riveted joints of plates to the plates themselves. These, according to experiment, give the following results :—

Taking the cohesive strength of the plate at	100
The strength of the double-riveted joint was found to be	70
And the single-riveted joint	56

These proportions apply with great force to vessels requiring close riveting, such as ships and boilers that must be water-tight, and in calculation it is necessary to make allowances in that ratio.

STRENGTH OF SHIPS.—Of late years it has been found convenient to increase the length of steamers and sailing vessels to as much as eight or nine times their breadth of beam, and this for two reasons ; first, to obtain an increase of speed by giving fine sharp lines to the bow and stern ; and second, to secure an increase of capacity for the same midship section, by which the carrying powers of the ship are greatly augmented. Now, there is no serious objection to this increase of length, which may or may not have reached the maximum. But, unfortunately, it has hitherto been accomplished at a great sacrifice to the strength of the ship. Vessels floating on water and subjected to the swell of a rolling sea—to say nothing of their being stranded or beaten upon the rocks or sandbanks of a lee shore—are governed by the same laws of transverse strain as simple hollow beams, like the tubes of the Conway and Britannia tubular bridges. Assuming this to be true—and indeed it scarcely requires demonstration—it follows that we cannot lengthen a ship with impunity without adding to her depth or the sectional area of the plates in the middle along the line of the upper deck.

If we take a vessel of the ordinary construction, or what some years ago was considered the best—300 feet long, 41 feet 6 inches beam, and 26 feet 6 inches deep—we shall be able to show how inadequately she is designed to resist the strains to which she would be subjected. To arrive at these facts we shall approximate nearly to the truth by treating it as a simple beam ; and this is actually the case, to some extent, when a vessel is supported at each end by two waves, or when rising on the crest of another, supported at the centre with the stem and stern partially suspended. Now, in these positions the ship undergoes, alternately, a strain of compression and of tension along the whole section of the deck, corresponding with equal strains of tension and compression along the section of the keel, the strains being reversed according as the vessel is supported at the ends or the centre. These are, in fact, the alternate strains to which every long vessel is exposed, particularly in seas where the distance between the crests of the waves does not exceed the length of the ship.

It is true that a vessel may continue for a number of voyages to resist the continuous strains to which she is subjected whilst resting on water; but supposing in stress of weather, or from some other cause, she is driven on rocks, with her bow and stern suspended, the probability is that she would break in two, separating from the insufficiency of the deck on the one hand, and the weakness of the hull on the other. This is the great source of weakness in wrought-iron vessels of this construction, as well as of wooden ones, when placed in similar trying circumstances.

CHANGES IN PROGRESS.—Having directed attention to the strength of ships, and the necessity for their improved construction, we may now advert to the changes by which we are surrounded, and to the revolution now pending over the destinies of the navy, and the deadly weapons now forging for its destruction. It is not for us alone, but for all other maritime nations, that these Cyclopean monsters are now issuing from the furnaces of Vulcan; and it behoves all those exposed to such merciless enemies to be upon their guard, and to have their "Warriors," "Merrimacs," and "Monitors" ever ready, clothed in mail from stem to stern, to encounter such formidable foes. It has been seen, and every experiment exemplifies the same fact, that the iron ship, with its coat of armour, is a totally different construction to that of the wooden walls which for centuries have been the pride and glory of the country. Three-deckers, like the "Victory" and the "Ville de Paris" of the last century, would not exist an hour against the sea-monsters now coming into use.

The days of our wooden walls are therefore gone; and instead of the gallant bearing of a 100-gun ship, with every inch of canvas set, dashing the spray from her bows and careering merrily over the ocean, we shall find in its place a black demon, some five or six hundred feet long, stealing along, with a black funnel and flag-staff, on her mission of destruction, and scarcely seen above water, excepting only to show a row of teeth on each side, as formidable as the immense iron carcase that is floating below. This may, with our present impressions, be considered a perspective of the future navy of England—probably not encouraging—but one on which the security of the country may ultimately have to depend, and to the construction of which the whole power and skill of the nation should be directed. I have noticed these changes, which are fast approaching, from the conviction that the progress of the applied sciences is not only revolutionizing our habits in the development of naval constructions, as in every other branch of industry, but the art of war is undergoing the same changes as those which have done so much for the industrial resources of the country in times of peace. It is therefore necessary to prepare for the changes now in progress, and endeavour to effect them on principles calculated, not only to ensure security, but to place this country at the head of constructive art. It is to attain these objects that a long and laborious class of experiments have been undertaken by the Government, to determine how the future navy of England shall be built, how it should be armed, and under what conditions it can best maintain the supremacy of the seas. This question does not exclusively confine itself to armour-plated vessels, but also to the construction of ships which, in every case should be strong and powerful enough to contend against either winds and waves or to battle with the enemy. It is for these reasons that I have ventured to direct attention to the strength of vessels, and to show that some of our mercantile ships are exceedingly weak, arising probably from causes of a mistaken economy on the one hand, or a deficiency of knowledge or neglect of first principles on the other.

Now, it is evident that our future ships of war of the first-class must be long and shallow; moreover, they must contain elements of strength and powers of resistance that do not enter into the construction of vessels that are shorter and nearly double the depth. If we take a first-rate ship of the

present construction, such as the "Duke of Wellington," and compare it with one of the new or forthcoming construction, carrying the same weight of ordnance, we should require a vessel nearly twice the length and little more than half her depth. Let us, for example, suppose the "Duke of Wellington" to be 360 feet long and 60 feet deep, and the new construction 500 feet long and 46 feet deep; we should then have for the resistance of the "Duke of Wellington" to a transverse strain tending to break her back:—

$$W = \frac{a\,d\,c}{l}$$

Taking 60 as the constant, and the area of the bottom and upper deck as 1,060 square inches, we have

$$W = \frac{1{,}060 \times 60 + 60}{340} = 12{,}223 \text{ tons.}$$

as the weight that would break her in the middle. Let us now take the new ship, and give her the same area top and bottom, and again we have

$$W = \frac{1{,}060 + 46 \times 60}{500} = 5{,}851 \text{ tons,}$$

which is less than half the strength. From this it is obvious—if we are correct in our calculations—that the utmost care and attention is requisite in design and construction to ensure stability and perfect security in the build of ships.

MECHANICAL PROPERTIES.—It is unnecessary to give more examples in regard to strength, and the proportions that should be observed in the construction of our future navy. I have simply directed attention to it as a subject of great importance, and one that I am satisfied will receive careful instruction on the part of the Admiralty and the Comptroller of the Navy.

The next question for consideration is, the properties of iron best calculated to resist the penetration of shot at high velocities, and in this I am fortunate in having before me the experiments of the Committee on Iron Plates, which may be enumerated as under:—

Specific Gravity.	Tensile Strength in Tons per Square Inch.	Compression per Unit of Length in Tons.	Statical Resistance to Punching in Tons; 1-inch Plate.
7·7621	24·802	14·203	40·1804

REMARKS.—The specimens subjected to compression gradually squeezed down to one-half their original height, increasing at the same time in diameter till they attained 90 tons on the square inch.

In these experiments, four descriptions of iron were selected, marked A, B, C, D; the two first and last were taken from rolled and hammered iron plates, excepting C, which was homogeneous, and gave higher results to tension and dead pressure than the others.

In density and tenacity they stood as follows:—

Mark on Plates.	Density.	Tenacity in Tons.
A Plates	7·8083	24·644
B Plates	7·7035	23·354
C Plates, homogeneous	7·9042	27·032
D Plates	7·6322	24·171

Here it will be observed that the strengths are in the ratio of the densities, excepting only the B plates which deviate from that law.

On the resistance to compression, it will be seen that in none of the experiments was the specimen actually crushed; but they evidently gave way at a pressure of 13 tons per square inch, and were considerably cracked and reduced in height by increased pressure.

From the experiments on punching, we derive the resistance of A, B, C, D plates to a flat-ended instrument forced through the plate by dead pressure as follows:—

Mark on Plates.	Shearing Strain in Tons per Square Inch.	Ratio, taking A as Unity.
A Plates....................	19·511	1·000
B Plates....................	17·719	0·907
C Plates....................	27·704	1·168
D Plates....................	17·035	0·873

Here may be noticed, that the difference between the steel plates of series C, and the iron plates of series A, is not considerable, though in all others the steel plates exhibit a superiority in statical resistance.

Having ascertained, by direct experiment, the mechanical resistance of different kinds of iron and steel plates to forces tending to rupture, it is interesting to observe the close relation which exists between not only the chemical analysis as obtained by Dr. Percy, but how nearly they approximate to the force of impact, as exhibited in the experiments with ordnance at Shoeburyness.

Dr. Percy, in his analysis, observes that of all the plates tested at Shoeburyness, none have been found to resist better than those lettered A, B, C, D, with the exception of C. The iron of plate E contained less phosphorus than either of the three, A, B, D, and it is clearly established that phosphorus is an impurity which tends in a remarkable degree to render the metal "cold short," *i. e.*, brittle when cold.

The following table shows the chemical composition of these irons:—

Mark.	Carbon.	Sulphur.	Phosphorous.	Silicon.	Manganese.
A	0·01636	0·104	0·106	0·122	0·28
B	0·0327	0·121	0·173	0·160	0·029
C	0·023	0·190	0·020	0·014	0·100
D	0·0436	0·118	0·228	0·174	0·250
E	0·170	0·0577	0·0894	0·110	0·330

Comparing the chemical analysis with the mechanical properties of the irons experimented upon, we find that the presence of 0·23 per cent. of carbon causes brittleness in the iron; and this was found to be the case

in the homogeneous iron plates marked C; and although it was found equal to A plates in its resistance to tension and compression, it was very inferior to the others in resisting concussion or the force of impact. It, therefore, follows that toughness combined with tenacity is the description of iron plate best adapted to resist shot at high velocities. It is also found that wrought-iron, which exhibits a fibrous fracture when broken by bending, presents a widely different aspect when suddenly snapped asunder by vibration, or by a sharp blow from a shot. In the former case the fibre is elongated by bending, and becomes developed in the shape of threads as fine as silk, whilst in the latter the fibres are broken short, and exhibit a decidely crystalline fracture. But, in fact, every description of iron is crystalline in the first instance; and these crystals, by every succeeding process of hammering, rolling, &c., become elongated, and resolve themselves into fibres. There is, therefore, a wide difference in the appearance of the fracture of iron when broken by tearing and bending, and when broken by impact, where time is not an element in the force producing rupture.

If we examine with ordinary care the state of our iron manufacture as it existed half a century ago, we shall find that our knowledge of its properties was of a very crude and most imperfect character. We have yet much to learn, but the necessities arising from our position as a nation, and the changes by which we are surrounded, will stimulate our exertions to the acquisition of knowledge, and the application of science to a more extended investigation of a material destined, in course of time, to become the bulwark of the nation. It is, therefore, of primary importance that we should make ourselves thoroughly acquainted not only with the mechanical and chemical properties of iron, but that we should moreover be able to apply it in such forms and conditions as are best calculated to meet the requirements of the age in which we live.

Entertaining these views, I cheerfully commenced with my talented colleagues the laborious investigations in which we are now engaged; and looking at the results of the recent experiment with the 300-pounder gun on the one hand, and the resting targets on the other, there is every prospect of an arduous and long-continued contest.

From the Manchester experiments, to which I have alluded, we find that with plates of different thicknesses the resistance varies directly as the thickness, that is, if the thickness be as the numbers 1, 2, 3, &c., the resistance will be as 1, 2, 3, &c.; but those obtained by impact at Shoeburyness show that, up to a certain thickness of plate, the resistance to projectiles increases nearly as the square of the thickness. That is, if the thickness be as the numbers 1, 2, 3, 4, &c., the resistance will be as the numbers 1, 4, 9, 16, &c., respectively. The measure, therefore, of the absolute destructive power of shot is its *vis viva*, not its momentum, as has been sometimes supposed, but the work accumulated in it varies directly as the weight of the shot multiplied into the square of its velocity.

There is, therefore, a great difference between statical pressure and dynamical effect; and in order to ascertain the difference between flat-ended and round-ended shot, a series of experiments were undertaken with an instrument or punch exactly similar in size and diameter, and precisely corresponding with the steel shot of the piece ·85 diameter employed in the experiments at Shoeburyness. The results on the A, B, C, and D plates as follows.

These pages show that the statical resistance to punching is about the same, whether the punch be flattened or round-ended, the mean being in the ratio of 1,000; 1,085 or 8½ per cent. greater in the round-ended punch. It is, however, widely different when we consider the depth of indentation of the flat-ended punch, and compare it with that produced by the round-ended one, which is 3½ times greater. Hence we derive this remarkable

Character of Plates.		Resistance lbs.	
		Punch Flat-ended.	Punch Round-ended.
Half-inch thick	A Plates	57,956	61,886
	B Plates	57,060	48,788
	C Plates	71,035	85,524
	D Plates	46,080	43,337
Three-quarter-inch thick	B Plates	84,587	98,420
	D Plates	82,381	98,571
	Mean	67,017	72,754

deduction, that whilst the statical resistance of plates to punching is nearly the same, whatever may be the form of the punch, yet the dynamic resistance or work done in punching is twice as great with a round-ended punch as with a flat-ended one. This of course only approximately expresses the true law; but it exhibits a remarkable coincidence with the results obtained by ordnance at Shoeburyness, and explains the difference which has been observed in these experiments, more particularly in those instances where round shot was discharged from smooth-bored guns at high velocities. To show more clearly the dynamic effect or work done by the weight of shot which struck some of the targets at different velocities, the following results have been obtained :—

Target.	Weight of Shot Striking Target.	Work done on Target.	
		Total.	Per Square Foot.
	lbs.	Foot lbs.	Foot lbs.
Thorneycroft 8-inch shield	1,253	—	29,078,000
Thorneycroft 10-inch embrasure	1,511	—	37,140,000
Robert's target	946	822,000	19,726,000
Fairbairn's target	1,024	324,000	23,311,000
Warrior target	3,229	312,000	62,570,000
The Committee's target	6,410	—	124,098,780

From the above, it will be observed, that the two last targets have sustained in work done what would, if concentrated, be sufficient to sink the largest vessel in the British navy.

We are all acquainted with the appearances and physical character of artillery, but few are conversant with the nature of the operations and the effects produced by shot on the sides of a ship or on resisting forts and targets.

The shot of a gun—to use the expression of my colleague, Mr. Pole—is simply the means of transferring mechanical power from one place to another. The gunpowder in the gun develops by its combustion a certain quantity of mechanical force, or work as it is now called, and the object of the shot is to convey this work to a distance, and apply it to an object supposed to be otherwise inaccessible. The effect of this, according to Mr. Pole's formula, is—

W = its velocity in feet per second.
V = weight of the shot in lbs.

Then, by the principle of *vis viva*, the quantity of work stored up by the moving mass, measured in lbs. one foot high, is—

$$= \frac{W V^2}{2 g}$$

g being the force of gravity = 32 1-6th.

Thus, if we have a shot, like that recently used against the Warrior target, 156 lbs., moving at the rate of 1,700 feet per second, the work done will be—

$$= \frac{156 + (1700)^2}{64\frac{1}{3}} = 7{,}008{,}238 \text{ one foot high.}$$

Showing at once the immense power that this small body is able to deliver on every resisting medium tending to arrest its course and bring its particles to a state of rest. Or, in other words, it is equivalent to raising upwards of 3,000 tons a foot high in the air.

The Application of Iron for Purposes of Defence.—Having examined, in a very condensed and cursory manner, the present state of our knowledge in regard to iron, and its application to the purposes of shipbuilding, let us now consider in what form and under what circumstances it can best be applied for the security of our vessels and forts. To the latter the answer is, make the battery shields thick enough; but a very different solution is required for the navy, where the weight and thickness of the plates is limited to the carrying powers of the ship. It has been observed with some truth that we have learnt a lesson from the recent naval action on the American waters; but it must be borne in mind that neither of the vessels engaged nor the ordnance employed were at all comparable to what have been employed at Shoeburyness.

To those who, like myself, have gone through the whole series of experiments, the late engagement will appear instructive, but not calculated to cause any great alarm, nor yet effect any other changes than those primarily contemplated by the Government, and such as have been deduced from our own experiments. It is, nevertheless, quite evident that our future navy *must be entirely of iron;* and, judging from the last experiment with the Armstrong smooth-bore gun, it would almost appear as a problem yet to be solved, whether our ships of war are not as safe without iron armour as with it. If our new construction of ships are strong enough to carry armaments of 300-pounder guns, which is assumed to be the case, our plating of six or seven inches thick would be penetrated, and probably become more destructive to those on board than if left to make a free passage through the ship. In this case we should be in exactly the same position as we were in former days with the wooden walls; but with this difference, that if built of iron the ship would not take fire and might be made shell proof. It is, however, very different with forts, where weight is not a consideration, and those I am persuaded may be made sufficiently strong to resist the heaviest ordnance that can be brought to bear against them. In this statement I do not mean to say that ships of war should not be protected; but we have yet to learn in what form this protection can be effected to resist the last powerful ordnance, and others of still greater force which are *looming in the distance*, and are sure to follow.

A great outcry has been raised about the inutility of forts; and the Government, in compliance with the general wish, has suspended those at Spithead: I think improperly so; as the recent experiments at Shoeburyness clearly demonstrate that no vessel, however well protected by armourplates, could resist the effects of such powerful artillery; and instead of the contest between the Merrimac and the Monitor, and that of the 300-pounder gun being against, they are to every appearance in favour of forts. Should this be correct, we have now to consider how we are to meet and how resist the smashing force of such powerful ordnance as was levelled against the "Warrior" target.

During the whole of the experiments at Shoeburyness I have most

intently watched the effects of shot on iron plates. Every description of form and quality of iron has been tried, and the results are still far from satisfactory; and this is the more apparent since the introduction of the large 300-pounder, just at a time when our previous experiments were fairly on the balance with the 40, 68, 100 and 126 pounders. They now appear worthless, and nothing is left but to begin our labours again *de novo*.

It has been a question of great importance, after having determined the law of resistance and the requisite quality of iron to be used as armour-plates, how these plates should be supported and attached to the sides of the ship. Great difference of opinion continues to exist on this subject,—some are for entirely dispensing with wood; probably the greater number contend for a wood backing, the same as the "Warrior" and the "Black Prince." I confess myself in the minority on this question; and, judging from the experiments, I am inclined to believe from past experience that wood combined with iron is inferior to iron and iron in its power of resistance to shot; and I am fully persuaded that ultimately the iron armour-plates must be firmly attached to the side, technically called the skin, of the ship. It must, moreover, form part of the ship itself, and be so arranged and jointed as to give security and stability to the structure.

The experiments instituted by the committee on iron plates have been well considered and carefully conducted; they commenced with a series of plates selected from different makers, of varying thicknesses, and these have been tested both as respects quality and their powers of resistance to shot. They have, moreover, been placed at different angles and in a variety of positions, and we had just arrived at the desired point of security, when the thundering 300-pounder smooth bore upset our calculations and levelled the whole fabric with the ground. We are, however, not yet defeated; and true to the national character, we shall, like the knights of old, resist to the last—

> "And though our legs are smitten off,
> We'll fight upon our stumps."

And thus it will be with the Iron Committee and the Armstrong and the Whitworth guns.

In conclusion, allow me to direct attention to a drawing of the "Warrior" target, with wood backing and its compeer entirely of iron. The first underwent a severe battering, previous to the attack from the 300-pounder, but the other sustained still greater, with less injury to the plates, notwithstanding the failure of the bolts in the first experiment. It must, however, be admitted that plates on wood backing have certain advantages in softening the blow, but this is done at the expense of the plate, which is much more deflected and driven into the wood, which, from its compressibility, presents a feeble support to the force of impact. Again, with wood intervening between the ship and the iron plates, it is impossible to unite them with long bolts so as to impart additional strength to it; on the contrary, they hang as a dead weight on her sides, with a constant tendency to tear her to pieces. Now, with iron on iron we arrive at very different and superior results. In the latter, the armour-plates, if properly applied, will constitute the strength and safety of the structure; and, notwithstanding the increased vibration arising from the force of impact of heavy shot, we are more secure in the invulnerability of the plates and the superior resistance which they present to the attack of the enemy's guns. In these remarks, I must not, however, attempt to defend iron constructions where they are not defensible, and I am bound to state that in constructions exclusively of iron, there is a source of danger which it is only fair to notice, and that is, that the result of two or more heavy shot, or a well concentrated fire, might not only penetrate the plates but break the ribs of the ship. This occurred in the last experiment on my

own target, where a salvo of six guns concentrated four on one spot, not more than 14 inches diameter, went through the plates and carried away part of the frame behind. The same effect might have taken place on the "Warrior" target; and certainly 9 inches of wood is of little value when assailed by a powerful battery of heavy ordnance and a well concentrated fire.

In closing these remarks, I have every confidence that the skill and energy of this country will keep us in advance of all competitors, and that a few more years will exhibit to the world the Iron Navy of England, as of old, with its wooden walls, unconquerable on every sea.

Since the above was written, another experiment has been made on the "Warrior" target with the 300-pounder smooth-bore gun. From this it appears that the wood backing between the armour plates and the skin of the ship cannot safely be dispensed with, and that some compressible or softer substance than iron, and iron is necessary to deaden the blow, and absorb the fragments of the shot and the broken plates, which in this instance lodged in the wood, and did not perforate, but only cracked the skin of the target. From this fact it cannot be denied that this experiment is more satisfactory than those on the iron on iron targets; and however desirable it may be to realise a more effective construction as regards the strength of the ship, it cannot be doubted in so far as the security of the ship and the lives of those on board are concerned, that a vessel with wood backing is safer in action than one composed entirely of iron. In the present state of our knowledge the experiments are therefore against iron and iron, as regards security from the effects of shot, but they are unfavourable as respects the strength of the ship.

THE BOARD OF TRADE RETURNS.

The Board of Trade Returns for the month of June, and the six months ending June 30th, were issued on July 28th.

The declared value of coal, cinders, and culm, exported during the month was 279,407*l.*, being a decrease of 67,244*l.* as compared with the corresponding period of the preceding year.

The exports of metals and metallurgical products were as follows:—

	Month ending June 30th.		
	1860.	1861.	1862.
	£	£	£
Iron, pig and puddled	78,479	108,414	98,587
Iron, bar, angle, bolt, and rod	157,546	171,735	177,637
Railway iron, of all sorts	305,592	293,559	222,523
Iron wire	13,997	20,213	25,082
Iron, cast	93,621	79,904	37,604
Iron hoops, sheets, and boiler-plates	84,408	89,272	95,511
Iron, wrought, of all sorts	169,635	181,742	160,793
Iron steel, unwrought	53,284	54,553	78,546
Copper, ditto	13,179	30,454	37,071
Copper, wrought	151,003	136,807	133,207
Copper, wrought, of other sorts	15,126	22,360	16,415
Lead	52,421	33,170	106,969
Alkali: Soda	77,222	41,443	67,648
Tin, unwrought	39,371	28,089	25,318
Tin-plates	93,806	74,476	105,731

Compared with the same month of last year, the chief features are the decrease in railway iron, and the increase in tin plates and lead.

MANCHESTER GEOLOGICAL SOCIETY.

At the meeting of this Society, on Tuesday, the 24th of June, E. W. Binney, Esq., F.R.S., Senior Vice-President, in the chair, after some observations by the chairman on the hour of meeting, Mr. Hull gave a short account of the discovery at Dukinfield, in beds supposed to belong to the upper part of the coal measures, of certain marine fossils hitherto considered to be confined to the lower coal measures, and to the series of strata below the Arley mine. Nothing less than a fault of 4,000 or 5,000 feet could bring the lower coal-measures into the position where these fossils were found. Mr. Taylor considered there was no possibility of such a fault existing; but the chairman thought there might be two or three faults between Clayton and the points in question, and as the district was a sort of *terra incognita* he was not yet thoroughly satisfied.

Mr. Atkinson having taken the chair, Mr. Binney delivered an address on the "Geology of Manchester and its neighbourhood."

Correspondence.

BLACK AND CLAY-BAND IRONSTONES.

Sir,—After sending you the query you did me the honour of publishing in your magazine of last month, upon the subject of Black and Clay-band ironstone, it has occurred to me that as the ores of iron are valued somewhat differently in England and Scotland, the object of determining whether an iron ore belongs to the Clay or Black-band, may not seem of such importance to many of your readers as it really is to the iron masters in the west of Scotland. The importance of the question will be more appreciated by giving a few examples.

According to the ordinary definitions, a Clay-band is a carbonate of iron having clay as the matrix, or the principal part of the matrix; and a Black-band is a carbonate of iron having coaly matter as the principal matrix. The following analyses of ores may be given as representing these two classes, avoiding fractions and ingredients existing only in fractions of a per cent.

Clay-band.				Black-band.			
Protoxide of iron	33	39	39	Protoxide of iron	40	43	49
Clay matter	14	17	19	Clay matter	2	2	2
Lime	8	5	6	Lime	4	2	3
Magnesia	5	7	3	Magnesia	—	—	—
Coaly matter	2	2	2	Coaly matter	26	23	14
Carbonic acid, &c.	37	30	31	Carbonic acid, &c.	28	30	32
	100	100	100		100	100	100

A great many of the iron ores in this locality do not come so distinctly under any of the two classes as these examples; so that when the chemist fixes upon the class to which the sample he is testing belongs, he is expected, and, indeed, it is necessary for him, to give reasons for his decision. Let us take an ore with the following composition:—

Protoxide of iron	44
Lime	7
Magnesia	5
Clay matter	6
Coaly matter	3
Carbonic acid, &c.	35
	100

This ore is classified by some as a Clay-band, not from the clay it contains, but from there not being coaly matter sufficient to calcine the ore without additional fuel—thus making coaly matter the distinguishing ingredient between the two classes of ore, and that in proportion requisite to burn and calcine the ore without additional fuel. Taking this data as our guide, to which class would the two following ores belong?

	No. 1.	No. 2.
Protoxide of iron	53	45
Lime	3	—
Magnesia	2	—
Coaly matter	3	12
Clay matter	37	16
Carbonic acid, &c. .. .	37	27
	100	100

No. 1 will require coal added to calcine it, while No. 2 contains sufficiently coaly matter to calcine it without any addition; yet to call the latter a Black-band and the former a Clay-band would be absurd, and unjust to both buyer and seller.

I will add a few more analyses out of many; and probably some of your readers will be able to give them a place in one of the two classes, and at the same time explain their reasons for doing so.

	No. 3.	No. 4.	No. 5.	No. 6.
Protoxide of iron ..	45	54	53	46
Lime..	7	—	1	3
Magnesia	1	—	—	2
Coaly matter ..	3	—	3	5
Clay matter.. ..	12	11	4	11
Carbonic acid, &c. ..	32	35	39	33
	100	100	100	100

AN ASSAYER.

Glasgow, *August 12th.*

METALLURGY OF LEAD.

SIR,—Having seen a brief notice in one of the journals of a scheme for making "bad lead good," if you, or any of your readers, know the details of the same, would you be good enough to give them in your next number, and oblige—

A SUBSCRIBER.

August 14th, 1862.

[We presume our correspondent refers to methods of softening hard lead. The old processes are well known, and certain new processes have also been recently introduced. Some of these, we understand, are found to work very well; but not being the subjects of patents they are worked as privately as possible.—ED.]

Legal Notes.

The Stannaries' Court held its usual quarterly sittings at Truro on the 6th. There were no cases of any special interest.

At the last Bristol Assizes, some curious facts transpired in the case of *Sandford* v. *Smith*, as to how a certain class of mining affairs is conducted in Devonshire. The plaintiff is a share broker at Exeter of respectable standing, and the defendant is professionally an organ builder and musician at the same city, but seems to act also as a mine broker. In 1861, they became connected with a certain mine near Buckfastleigh, called the East Brookwood Mine, associated with a Captain Williams. A complicated series of share transactions took place between all the parties, the defendant being employed to sell shares on commission among his connection. Amongst others, he sold certain shares to Major Manley for 300*l*., but only accounted for and received commission on 200*l*, retaining the difference, for which he was now sued, and for which the plaintiff received a verdict. In the cross-action of *Smith* v. *Sandford*, Mr. Smith claimed 75*l*. for commission on certain shares sold by him for Mr. Sandford, and which were honoured for by bill, the bill, however, never having been paid. The verdict in this action was for the defendant, so that in both cases Mr. Sandford succeeded.

The notorious Griffiths and Izod case came again before the public at the last Gloucester Assizes in the cause *Wright* v. *Izod*, in which the plaintiff claimed 1,000*l*. on a bill of exchange, drawn by Mr. Samuel Griffiths, of Wolverhampton, on the defendant, an iron merchant of Birmingham, and endorsed by Griffiths to a Mr. Wood, and by Wood to the plaintiff. The defence was that the bill, together with another for the like amount since paid, and 1,000*l*. in cash, had been originally obtained by fraud on pretence of supplying iron which Griffiths had not the means of doing; and that no substantial consideration had been given by Wood, who besides had notice of the want of consideration, and that plaintiff was the agent for Wood. The jury found for the defendant on all the issues.

The case of *Oxlade* v. *The North-Eastern Railway Company* (See Vol. I, p. 336), has been tried at the last York Assizes before Chief Justice Erle and a special jury, and on this occasion has resulted in a verdict for the defendant. At the York Summer Assizes, 1860, Mr. Oxlade obtained a verdict against the Company for refusing to carry coal for him upon every part of their railway, and in particular from Whitwell, Schincliffe, and Ferry Hill Stations, the jury finding that the company were common carriers. This verdict was afterwards set aside by the Court of Common Pleas, from whose decision Mr. Oxlade appealed to the Court of Exchequer, who ordered a new trial to take place. All through, Mr. Oxlade has conducted his own case in a suitable manner it is admitted; but still, as the Chief Justice said, with enormous inconvenience to the court, his opponents, and himself. Mr. Oxlade's means being thoroughly exhausted we regret to hear that he is now confined in York Castle for the costs of this cause, and that he is petitioning the Court of Bankruptcy *in formâ pauperis*, so that this litigation, which has been pending such a length of time, may now be considered at an end. In fighting this case for such a length of time, Mr. Oxlade no doubt considered he was combating an injurious monoply; but the ruling of the judge in this case, that railway companies are not necessarily common carriers of coal from all their stations, is evidently a sound one.

The case of *Williams* v. *Williams and others* in the Court of Chancery, before Vice Chancellor Sir W. P. Wood, has created considerable interest in Cornwall. The plaintiff was Mr. John Michael Williams, and the defendants Messrs. William Williams, George Williams, Sampson Foster, Edward

Williams, and Frederick Martin Williams, all partners in the well-known copper smelting firm of Williams, Foster and Co. The bill was filed for a dissolution of partnership, and the appointment of a receiver to wind-up. With the exception of Mr. Foster, all the other defendants are the nearest relatives of the plaintiff, being his brothers, uncle, and first cousin. The firm was first founded in the year 1822, the original partners being Mr. John Williams, of Scorrier (the paternal grandfather of the plaintiff), with his four sons: John Williams, jun. (dead), Michael Williams (dead, the father of the plaintiff), Edward Williams (dead), the defendant, Mr. William Williams (the only survivor of the Williams family of the original partners), and certain other persons, all of whom have since died or retired. The partnership was originally for twenty-one years, and the name of the firm was "Fox, Williams, Grenfell, and Co." The Foxes and Mr. Grenfell having retired, and Messrs. Joseph Talwin Foster (since dead), and Sampson Foster having been admitted as partners, the firm was henceforth conducted as "Williams, Foster and Co." In 1835, the plaintiff, the eldest son of Mr. Michael Williams was admitted as a partner, and in 1840, the capital of the firm was fixed at 400,000*l.*, in 80 shares of 5,000*l.* each. In 1843, the original term of twenty-one years (from 1822) expired, and the partnership was continued without any new articles being entered into. After the admission of the plaintiff in 1835, the business was conducted by Messrs. John Williams, jun., and Michael Williams as salaried managing partners; and after the death of Mr. John Williams, jun., in 1849, it was managed by Mr. Michael Williams and the plaintiff. Mr. Michael Williams died on the 17th of June, 1858, and since then the plaintiff, who inherited the greater portion of his father's shares in the firm, continued to manage the business, his younger brothers, Mr. Michael Henry Williams and Mr. George Williams, assisting him to some extent. The business greatly increased and prospered, and in July, 1861, the assets were estimated at no less than 750,000*l.* In November, 1860, Mr. Rd. Harvey and Mr. Michael Henry Williams retired from the partnership, selling their shares to the remaining partners, and Mr. Frederick M. Williams, son of Mr. William Williams, was admitted a partner. In February, 1861, Mr. Joseph Talwin Foster died, and by his will he bequeathed all his interest in the partnership business to his brother Mr. Sampson Foster.

At this period a family quarrel seems to have arisen among the Williams family. The plaintiff, deeming that the assistance of his brothers in the management was not sufficient, desired that a junior partner of business habits should be admitted, and proposed that his brother-in-law, Mr. Horton Davey, of Redruth, who was an agent of the firm, should be admitted, and that he (the plaintiff) should be at liberty to transfer to him a part of his interest. Mr. George Williams and Mr. William Williams positively refused to accede to this proposal. A good deal of negotiation followed, but plaintiff still insisting on Mr. Davey being admitted as partner, and Mr. George Williams and Mr. William Williams as strongly persisting in their refusal, the plaintiff, on the 30th July, 1861, gave notice to dissolve the partnership. At this period the shares of the several partners were as follows:

	Shares.
Mr. John Michael Williams	28 13-16
" William Williams	25 13-16
" Sampson Foster	10
" George Williams	9
" Frederick Martin Williams.. ..	2
" Edward Williams	2 14-16
" In trust for minors	1 8-16
	80

The question to be decided by the Court was, whether, since the expiration of the original articles in 1843, the partnership (as contended by the plaintiff) had been carried on merely at will; or whether (as contended by the defendants) there had not been an agreement entered into, in 1845, for a renewal of the partnership for a fresh term of fourteen years; and, on the expiration of this term in 1859, a new agreement for another term of fourteen years. On these points there was a considerable conflict of evidence. For the defendants it was submitted that, although no deed had been signed, there had been a renewal of the partnership by agreement, in 1845, for a term of fourteen years, which expired in 1859, when the question of renewal was started again, and negotiations came on for another renewal for fourteen years. That such negotiations were entered upon was admitted, but the Vice-Chancellor held that no definite terms were shown to have been settled, and that indeed there seemed to have been a difference of opinion as to what the succession clause should be. As he pointed out, no one alleged that, in 1859, there was to be a mere renewal on the terms of the original partnership—or those terms modified by practice—it being admitted on all hands that an important alteration was to be made in the succession clause. His Honour also considered that the defendants attached too much importance to what occurred in March, 1844, particularly as it was admitted that, at the term of expiration of the original twenty-one years in 1843, no immediate steps were taken for renewing the term. In fact, nothing was done until the pecuniary requirements of Messrs. Foster brought about a meeting, when they gave up $\frac{4}{16}$ths in consideration of a considerable advance. He considered that the facts showed that no negotiation took place till they had a moving cause in the position of the Fosters; and he thought the evidence of what then occurred fell very far short of proving an absolute renewal of partnership for fourteen years. One of the strongest points made on behalf of the defendants was that when, in November, 1859, Mr. Michael Henry Williams, and Mr. Richard Harvey desired to go out of the concern, the firm paid them some 150,000*l.* for their shares. It was incredible, it was contended, to suppose that the remaining partners would purchase the shares of outgoing partners at so large an amount if the partnership were merely at will, terminable at the pleasure of any one of them. His Honour, however, disregarded this reasoning, and held that there was nothing to show that the parties were bound to continue partnership for fourteen years. He therefore considered the plaintiff entitled to a decree declaring the partnership dissolved from the 30th July, 1861, with the usual order for accounts. Any of the partners to be at liberty to propose themselves, or such other persons as they think fit, as receivers and managers.—In the course of the case it was stated that so profitable was the business that 120,000*l.* profits had accumulated in the hands of the bankers pending the dispute.

Mining, Quarrying, and Metallurgical Review.

CORNWALL AND DEVON.

During the past month, mining in these counties has been marked by considerable dullness. As a rule, the mines are not looking quite so well, which, coupled with a natural reaction from a recent period of inflation, has

caused a general feeling of depression. Still, copper and tin hold their prices better than could have been anticipated, and on the whole, compared with other branches of production, Cornish mining industry seems to have no good reason to complain.

Wheal Ludcott still occupies the foremost place in the attention of those connected with the share market, and the widely conflicting reports that have been given, have made the merits of the mine almost a personal matter. Captain Thomas Trevillion and Captain Henry James condemn the mine *in toto*, even as a speculative lead mine; while others make out that Ludcott is not only another Potosi for silver, but is also capable of at once making permanent profits as a lead mine. Moderate views, which describe Ludcott to be a promising, but certainly not a rich, lead mine, seem to be scouted on both sides. In the silver department we are more prepared for violent differences of opinion, and we have them to our heart's content. Captain Charles Thomas in a report states he does not expect any rich silver ground below the 80, and estimates the amount standing above that level at from 6,000*l*. to 8,000*l*.; while Mr. Thomas Faull, M.E., described, as late of the New Almaden Mines, California, speaks of the silver reserves as "astounding"—not a very definite estimate by the way—and says that, in his opinion, they will continue not only to the 96 but to the 196.. We have already given our opinion as to the full confidence that may be placed in Captain Knapp's statements of fact, and consequently the following made in a letter to the *Mining Journal*, should have, and no doubt has had, considerable weight with the public: "I do not like in general to speculate too far on the distant future; but under existing circumstances feel almost compelled to say that in the next twelve months this mine will probably exceed in its profits any other lead mine in Cornwall;" to this, Captain Knapp goes on to add the following expression of opinion, which of course must only be taken, as an expression of opinion for what it is worth, "and, for anything I know to the contrary or can possibly conceive, it will then present as good appearances as it does now, and probably better." No inspector, taking a cursory view of a mine, can possibly be so good a judge of its discovered resources as the agent who has seen the ground opened from day to day; but with regard to the prospects of future discoveries, the agent on the mine is in no better position to form an opinion than a stranger, if the latter is an experienced miner. Hence, while Captain Knapp's opinion as to the actual discovered resources of this mine must be received as far superior to that of any other person, we cannot consider his opinions as to the probabilities of future discoveries as possessing greater weight than those of Captain Charles Thomas.

At Great Wheal Fortune, in Breage, the position of the mine is not quite so good as it has been. The bottom level, the 78, driving west from Hoskin's, and east from Painter's shafts, has not gone through such a rich run of tin-ground as the level above. The tin-ground on the whole has lengthened in this level, but the rich bunch seems to have shortened, or it ought to have intersected in the 78 ends before this. This slight falling off does not effect the intrinsic position of the mine, for things of this kind must always be looked for in mining, and the prospects of the Carnmeal lode making a great tin mine are quite as good as ever they were. The back of the 78 has not been touched yet, nor will it be until the levels have been holed, which will be in about two months: by that time the Engine shaft will be down another lift and a 90 fathoms level driving. The winze below the 68 on this lode, now down 7 fathoms, sinking to meet the 78 levels, has been very rich, having turned out tin to the value of 200*l*. per fathom for the last 3 fathoms of sinking, as will be seen by the following particulars of the tin returned from that space of ground:—

Sacks.	Produce.	Price per Sack.	Amount.	Sacks.	Produce.	Price per Sack.	Amount.
	dwt. grs.	s. d.	£ s. d.		dwt. grs.	s. d.	£ s. d.
92	8 12	12 9	58 13 0	98	11 20	17 9	86 19 6
80	10 0	15 0	60 0 0	45	6 0	9 0	20 5 0
45	9 6	13 10½	31 4 4	90	7 16	11 6	51 15 0
82	9 16	14 6	59 9 0				
64	8 8	12 6	40 0 0	Total amount ..			428 10 10
45	6 0	9 0	20 5 0				

This being estimated at a standard of 60*l.*, the real value of the tin being upwards of 70*l.*, we have (adding ⅓th) a true value of 599*l.* 10*s.* 4*d.*, or just 200*l.* per fathom, for a winze 10 feet long.

At Wheal metal, also in this district, an improvement has taken place, the lode having been found and cut rich in the bottom level. In referring last month to the mine adjoining this, Sithney Wheal Metal, we mentioned the name of Mr. William Burgess, of Camborne, as the principal proprietor. Since that was written, Mr. Burgess has died, at the advanced age of 86, enjoying to the last the vigour of his understanding. Cornwall has also lost, within the last month, one of her leading mining adventurers, in Mr. Richard Pearce, of Penzance, who died at the age of 70. Mr. Pearce, who in youth was a fellow student of Sir Humphry Davy, was one of the best known men in West Cornwall, both in his public and private capacities. As a miner he was of the old-fashioned school, that thought more of the mines than the market, and of which the best specimens are still to be found in the district west of Penzance. Mr. Pearce was purser of Boswidden, Carnyorth, and Spearn Consols, as well as joint purser for Wheal Reeth with Messrs. Rodd and Higgs.

The new Redruth Tin Company have commenced operations, having laid in a considerable stock of black tin. The position of the works being convenient for the mines, and the partners being largely interested in mining affairs, they are expected to do a large business.

Apropos to new smelting companies, Captain Charles Thomas, of Dalcoath, has addressed a communication to the *West Briton* explaining the objection he made to the bids of the Neath Copper Company being received. He suggests that the friends of Mr. Horton Davey should give a written guarantee, to be deposited with one of the Cornish banks, that all the ores purchased by No. 13 should be paid for in the usual manner, as Captain Thomas properly says, "this ought not to be a party question;" the matter should be considered as a pure one of business, and as a matter of business it is clear that Captain Thomas's suggestion is quite impracticable. It rests with any mine at present to give or withhold the usual two months' credit with respect to any new company. Mr. Davey offered cash to those who wished it, and nothing more can be asked. As to a general guarantee, it is evidently impracticable, for if, as Captain Thomas suggests, it is troublesome and invidious to decide whether or not a new company can be trusted; it would evidently be much more difficult to decide on the responsibility of the guarantors. As to the Neath Copper Company, no one pretends in private to doubt for one moment that it is as well able to pay for the ores it buys as any company in the ticketing list. It is possible, however, in these days of speculation, that other companies of a different calibre may be entering the Cornish ticketing, and in such cases it will behove mine pursers to exercise proper caution. Such companies must, if they mean business, be prepared to do as Mr. Davey offered to do, that is, to pay cash for whatever ores they buy before they leave the mine. If any company is prepared to do this, that is all that can be required of them.

In West Cornwall, Wheal Seton seems to have been the most advancing mine within the last few months. At the meeting on the 11th the accounts

for May and June showed a credit balance of 1,919*l.* 7*s.* 7*d.* A dividend of 2*l.* per 396th share was made, leaving a balance of 1,127*l.* 7*s.* 7*d.* to be carried forward to the credit of the next account. The mine is looking very well, and is likely still further to improve.

West Seton, which adjoins this, seems on the other hand to have been rather falling off, for mines, like men, are but mortal, and the best must come to an end some day. Not that the end is at all near yet in West Seton, but the mine has probably seen its palmiest days. An interesting circular has been issued by the purser, Mr. Benjamin Matthews, of St. Day, showing the rise and progress of the mine, by which it appears that since dividends were commenced in 1855, 137,000*l.* has been divided in profits.—New Seton and South Seton, younger members of this large and flourishing family, have also improved recently. The former is as near a certainty as anything in mining can be; and South Seton is now also becoming a fairly promising concern, after a long and at times rather a gloomy drag

WALES AND THE BORDERS.

South Wales.—The large quantities of iron which have recently been exported to the various European marts, and the continued demand which still exists for good qualities of bar and railway iron, has caused considerable activity amongst makers. The trade with the United States is gone, and latterly there has been an almost a total cessation of exports of iron either to India or China, or ports of South America. The exports, therefore, are European, the Russian, Spanish, and Portuguese ports, being by far the principal consumers. From the reports which have reached us, a comparatively good business has been done in the home trade, and although makers could produce larger quantities than at present required, yet the iron trade of South Wales at the present must be considered satisfactory, and the Custom House returns for the past month show that a considerable improvement has taken place. Nearly 5,000 tons of iron were exported from Cardiff alone, during the week ending August 9th, whilst considerable quantities were also despatched from Newport, Port Talbot, Neath, and other ports. It must not be supposed, however, that the iron trade has attained that general activity which characterized it a few years back, or that makers find any difficulty in executing the orders on hand; all that can be said is that, upon the whole, the mills and forges are well occupied, and the men well employed; whilst as a proof that the merchants themselves anticipate still more prosperous times, we may mention that steps are being taken to re-light several additional furnaces which have long been unused. The Tredegar works are in full employ, and preparations are being made for lighting additional furnaces at Aberyschan.

Notwithstanding the general depression of trade throughout the country, and almost entire suspension of business with America, the shipping trade of the various ports of South Wales has been active during the past month; in fact, Cardiff exported more coal, both to foreign and home ports, during the month of July, than any given month before, whilst the shipment of iron was also heavy. From the statistical returns of the trade of the port, just published, we find that the total quantity of coal shipped to foreign ports during the month was 129,052 tons, a large quantity being also sent coastwise. There were also 23,208 tons of iron exported, 2,112 tons of patent fuel, and 811 tons of coke. The total shipments for the seven months of the present year are :—

	Coal.	Iron.
January	101,024	8,416
February	102,922	13,632
March	111,668	13,030
April	108,780	19,226
May	86,109	16,017
June	94,896	19,939
July	129,052	23,208

Compared with the three previous years, the exports for the past month are very favourable:—

	Coal.	Iron.
July, 1859	84,643	14,057
„ 1860	101,033	14,273
„ 1861	105,432	10,336
„ 1862	129,052	23,208

The total exports of the seven months of 1860, 1861, and 1862 were—

	Coal.	Iron.
1860	603,091	102,763
1861	628,652	77,719
1862	734,451	113,468

which show an increase in favour of this year over the corresponding period of 1861 of no less than 105,79.) tons of coal and 35,749 tons of iron. The general trade of the port is still active, and there is every reason to anticipate that the increase will be maintained, if not considerably augmented.

Perhaps Newport is the only port in the Bristol Channel where the trade seems to be gradually, but surely, declining. At a meeting of the Harbour Commissioners, held a few days ago, the returns of the trade of the port were produced, and show a falling off as compared with the previous months of this year, and also with the corresponding period of 1861.

Notwithstanding this decrease, the export trade is upon the whole brisk, the shipment of coal to coastwise ports especially being large. There are a large number of vessels now in port awaiting cargoes, and the coal trade will, consequently, be active for a few weeks to come.

There is a temporary depression in the shipping at Swansea, but the statistical returns of the trade of the port for the year ending June 30 show a considerable increase as compared with former years. The shipping rates received for the year were 15,208*l.* 7*s.*. the rates on goods imported, railway tolls, ballast rates, &c., making the total income 29,886*l.* 11*s.* 9*d.*, whilst the expenditure, including interest on bonded debt, was 25,175*l* 17*s.* 10*d.*, leaving balance in favour of the Trust, 4,708*l.* 13*s.* 11*d.* Referring to the trade of the past month, we find that the total number of vessels entering the port was 513, of the aggregate registered tonnage of 52,710 tons, and the shipping rates received were 1,204*l.* 11*s.* 7½*d.* For the corresponding month of 1861 the number of vessels was 507 ; aggregate tonnage, 52,460 tons; and shipping rates, 1,199*l.* 11*s.* 6½*d.* Nearly the whole of the vessels take out return cargoes, either of coal, patent fuel, or iron, and the figures given, therefore, prove that both the staple articles of trade at this port are in a satisfactory condition.

The following is an abstract of the trade of the port of Neath (including the Briton Ferry Docks), for the month ending July 31 :—

	No. of Vessels.	Tons register.	Tons burthen.
European trade	25	2,132	2,747
Coasting trade	205	14,362	21,992
Total	230	16,494	24,739

IMPORTS.—Copper ore, 4,008 tons ; pig-iron, 1,256 tons ; iron ore, 3,259 tons ; grain and flour, 772 tons; pit and cord wood, 439 tons ; timber, 187 tons; miscellaneous, 243 tons ; total, 10,164 tons.

EXPORTS.—Coal, coke, and culm, 20,291 tons; copper, 84 tons: bar-iron, 1,687 tons: pig-iron, 40 tons; tin plates, 382 tons; miscellaneous, 80 tons; total. 22,664 tons.

CARDIGANSHIRE.—In this county a company called the *Silver Mountain United Mines Company* (limited) is advertised. The objects are stated to be the purchase and working of "very valuable and extensive" silver lead mines called Pant-y-mawr and Cnwch-yr-arian, in the parish of Llanbadarnfawr, which in the prospectus are stated to be surrounded by Frongoch, Goginan, Logylas, Cwm-ystwith, Grogwinion, Cwmsymlog, Blaen-caenant, Cwmerfin, Glogfach, *and many other rich mines*, "*paying each from* 5,000*l. to* 20,000*l. per annum in dividends.*" That "each" of the mines mentioned, as well as "many others," are paying the profits stated, will, we anticipate, be rather news in Cardiganshire; and that such assertions are publicly made is rather remarkable. After this we are scarcely surprised at the statement that, from "careful surveys," a "rich course of ore recently intersected" is estimated from 80 to 100 fathoms long, "*and contains at least* 30,000*l. worth of ore above the adit level; the amount below being incalculable.*" Well may Captain Tregonning, manager of the Grogwinion Mines, one of the reporters on this mine, ask: "Where is there in Cardiganshire such a great chance of making profits; or, where is there in this county such a long distance driven in a deep adit, on such a splendid lode?" Where, indeed, Captain Tregonning! Captain Matthew Francis seems to be connected with this concern, which it is to be hoped will prove an exception to the other mines in this county he has been the means of bringing before the public, during the last seventeen or eighteen years, every one of which have ended in failure, although it is not a little remarkable that each of them were said at starting to have had prospects of success not much inferior to the 30,000*l.* worth of ore estimated in this case at the back of an adit level.

NORTH WALES.—A limited liability company has been formed, called the *Cambrian Consolidated Gold Mines Company*, capital 150,000*l.* in 75,000 shares, of 2*l.* each. Mr. Charles Martin, of the firm of Blogg and Martin, Diamond Merchants, Chairman of the Vigra and Clogau Gold Mining Company, is one of the directors. This Company is promoted under highly respectable and favourable auspices, forming in this respect a contrast to the generality of gold companies. It may be regarded as an off shoot of the Vigra and Clogau success, and being under practical and experienced direction, it is to be hoped and, indeed, anticipated that it may lead to similar, or at least approximately similar, successful results. Captain John Parry, referred to so favourably by Mr. Warington Smyth in his paper in a former number of this Magazine, reports well of it for gold.

Another gold company in the same district, called the *Dolfrw-y-nog Mining Company* (limited) is also advertised, capital 20,000*l.* in shares of 1*l.* each. Dolfrw-y-nog is one of the best known gold localities in Merionethshire, and has produced splendid specimens. During the gold mania of 1854-55, it was extensively worked and a large loss incurred; this, however, is no evidence that under judicious management it may not prove a profitable auriferous mine. Indeed, it would certainly seem to be one of the most promising localities for trial in the neighbourhood. It appears by the prospectus to be brought out at a premium of 10,000*l.*; 1,000*l.* in cash, 4,500*l.* in fully paid up shares, and a further amount of 4,500*l.* in fully paid up shares on payment of the first dividend.

The *Flintshire Lead and Zinc Company* (limited) is advertised, capital 150,000*l.* in 15,000 shares, of 10*l.* each, with power to increase to 250,000*l.* The direction is respectable, and the object of the company, besides the ordinary smelting of lead and zinc ores, seems to be the manufacture on a large scale of Bennett's Patent Tinned Lead Pipes for water

service. Premises have been secured at Bagillt on the Dee at a valuation, the vendor consenting to take two-fifths of the purchase money in shares. These premises include 30 acres of leasehold land, on which are erected lead and zinc furnaces, refineries, a rolling mill, desilverising pots, and other appliances. It is proposed to extend these by the immediate expenditure of 20,000*l.* in the erection of additional furnaces and machinery,

A limited liability company, called the *Bulkeley Coal, Iron-stone, and Fireclay Company*, with a capital of 20,000*l.*, in shares of 1*l.* each, is advertised. The object of this company is stated to be to "develop" certain mineral properties of a new coal field on the south side of Carnarvonshire. No names are given except that of the solicitor, and the district is new to us; but the prospectus promises an immediate return of 55 per cent. on the capital employed, from one seam alone, while other "lower," "richer," and "more profitable" seams are referred to as being still more easily won.

The recent discovery of a second series of coal and cannel in the neighbourhood of Mold has caused a *furore* of mining speculation in the district. There are eight new companies already in the field, many of which have a considerable subscribed capital. The seams already proved are a yard, 4 feet and 3 feet 6 inch coal, and the cannel seam of an average thickness of 3 feet 7 inches. These are satisfactorily proved by boring and actually sinking for upwards of five miles in a line running north and south over a large tract of the country. The 3 feet 6 inch coal is of a very superior quality, and will be highly valued for household purposes. The cannel, as already proved by analysis, is superior to any in the kingdom for distillation purposes. It is to be hoped the proceedings of these new companies will be more judicious than seems to be the case with some of them at present.

MIDLAND COUNTIES.

DERBYSHIRE.—There is a more hopeful feeling prevalent as to the future prospects of the Iron Trade, as the opinion gains ground in commercial circles that the war in America will not be of long duration. The demand for all descriptions of iron, with the exception of hoops, is more active than has been the case for several weeks past. There is an active demand for rails and railway iron work generally, which is not likely to abate, as two large contracts for home railways, and one for a continental line, are in the market. Pig-iron, of Derbyshire make, is in good demand, and more especially that required for the making of armour plates. The position of affairs in America is not satisfactory as regards the iron trade, and the orders which come to hand are executed with great caution on account of the difficulties experienced in obtaining remittances. The orders from the Continent, and especially from Russia, are generally larger than usual for this season of the year. For home consumption there is a good inquiry for rails, tools, and all kinds of engines and machinery. The steel trade is slightly improving, and the demand for hardware and cutlery for the Continent is now much better than for the past few months. There is also a better disposition on the part of merchants to speculate.

STAFFORDSHIRE AND WARWICKSHIRE.—There is no improvement in the staple trades of these districts; their condition, however, is not less satisfactory than it was, which tends to impart a better feeling than was prevalent a little time since. The principal demand is for plates and angle bars for roofing purposes. The extent of the present inquiry for iron for such uses is most encouraging, and is very indicative of the progress which is being made in the application of iron to purposes for which it was not until very recently, in any way used. The consumption, however, is tolerably large at the leading chain works of East Worcestershire, among

the most prominent of the orders recently received, is one for the Russian market. Contrary to experience in the general hardware, the miscellaneous trades of Birmingham and Wolverhampton for instance, the iron and chain trade with northern Europe, has not been materially affected by the recent and prevailing political disturbances in that part of the world. Good orders continue to be received on Russian account for sheets, chiefly for roofing purposes. The American market has not yet improved for best iron. Nevertheless not a little iron of an inferior description is being sent from this district to Liverpool, for the New York market. The demand for best iron in the shape of plates and angle bars, although not showing itself in specifications of great worth, yet is such as to keep the mills of the A1 houses in full activity.

The only branch of the home trade which, in addition to ship-building, is at all brisk, is the girder making. In that department the actual briskness has not much fallen off, though the prospects are, as may be expected, less favourable than they were. Here plates and angle bars of a second-class quality find a market. The pig-iron market keeps tolerably buoyant, and seeing that there are only half the furnaces in the United Kingdom in blast, it is likely to remain so. Stocks are being reduced rapidly in the hands of a few makers who possessed them, and there are satisfactory indications that they will continue to be reduced; and that if the make is not increased, prices will continue to tend upwards. This is clear from the circumstance that on the works of the makers of finished iron, the pig banks are, as a rule, sparingly strewn with this commodity, and that there is now being experienced a demand for puddled bars that has not for some time been observable. At works where more puddled bars are being rolled than are usually worked up at the mills of the same establishments, there are inquiries from other works for puddled bars, that it is impossible to meet. Twice as many puddled bars as are now saleable would find a ready market in this district, at fairly remunerative rates. This feature of the trade is exceptional, and is highly encouraging to the pig makers, at the same time that it shows that the demand for finished iron is pressing.

Coal still holds its own in the district, and the mining population continue well employed in the reduced number of mines and collieries that are now being worked.

NORTHERN COUNTIES.

NORTHUMBERLAND AND DURHAM.—The general trade of the two northern counties has not undergone any considerable change since last month, but trade continues to improve by slow and steady gradations. The coal trade remains about the same; many collieries are working more or less short time, but as the cold weather comes on business will no doubt improve. Owing to a general concurrence in the advice tendered on two or three occasions this year by the committee of the Coal Trade Association, the London coal market is in a better state than has been the case for some time, and with a view to maintain so desirable a position of affairs the committee have issued to the trade a circular in which they remark:— "I have it in direction from the chairman and general committee of the coal trade to express their gratification at finding that their appeals to the trade on the imperative necessity of a curtailment of shipments, most especially to the London market, have been responded to on the part of the coalowners. The committee cannot but believe that the owners of collieries will agree with them in this view, both of present circumstances and the prospects of the future, and act in accordance with that conviction. The course the committee would recommend is, for the collieries to adhere to the limited number of working days in each fortnight before mentioned,

until the state of the market shall be such as to warrant a discontinuance: a result which the committee trust a few weeks more will bring about, should this arrangement continue to be acted upon."

In the iron trade we have but little change to note. Prices range low, but the demand for iron of local brands is said to be tolerably active, and it is understood that some of the principal firms have heavy orders in hand, which will keep them busy for some time to come. A return of blast furnaces in Cleveland and South Durham on the 1st, gives the following figures:—

August 1, 1862	.... 55 in blast;	24 out of blast	.......Total	 79
" 1861	.... 54 "	25 "	"	 79
" 1860	.... 52 "	22 "	"	 74
" 1859	.... 54 "	13 "	"	 67
" 1858	.... 49 "	14 "	"	 63

Arrangements have been completed for "tapping" the Marchioness of Londonderry's two new blast furnaces at Nose's Point, about a mile to the south of Seaham harbour. They are capable of producing from 400 to 500 tons of iron per week, and will require from 1,200 to 1,500 tons of coke per week, and 60 tons of lime per day to reduce the ore.

The shipping trade is rather active and freights have a little advanced. Indeed, the shipowners, perhaps, have less to complain of than any other branch of local commerce considering the general depression. Among the exports from the Tyne during the month were 165,921 tons of coal and 2,997 tons of iron. Among the imports: cargoes of pyrites from Rotterdam, Pomaron, Genoa, Antwerp, &c.; 2,153 bars of iron from Gothenburg; 1,723 bars of lead and mineral ore and a cargo of sulphur ore from Seville, and a cargo of iron ore from Egersund.

The Trade and Revenue of the Wear.—From the River Wear Commissioners' half-yearly return, just issued, it appears that during the six months ending June 30, 1862, 5,537 vessels, registering 979,536 tons, cleared from the port of Sunderland, the tonnage rates of which vessels amounted to 5,543*l.* 6*s.* 7*d.*. In the corresponding half-year of 1861, the number of vessels was 5,616, registering 955,628 tons, and the tonnage rates received were 5,238*l.* 0*s.* 3*d.*, being a decrease of 79 vessels, but an increase of 23,908 register tons, or 2·5 per cent., and 305*l.* 6*s.* 4*d.* on the tonnage rates of corresponding half-year of 1861. Of the above vessels 2,767, registering 562,160 tons, paying 8,220*l.* 12*s.* 3*d.* dock tonnage rates, cleared from the South Dock, against 2,846 vessels, registering 539,308 tons, paying 7,729*l.* 8*s.* dock tonnage rates in corresponding half-year of 1861, being a decrease of 79 vessels, but an increase of 22,852 tons, or 4·2 per cent., and 1,100*l.* 4*s.* 3*d.* dock tonnage rates on the corresponding half-year of 1861. 361 vessels, registering 93,776 tons (loaded in the river) passed through the dock, against 292 vessels, registering 75,870 tons in corresponding half-year of 1861. The coasting trade shows an increase of 20,588 tons (of which due to dock 9,531 tons), being 3·8 per cent.; but the European trade shows a decrease of 8,228 tons (although that of the dock increased 3,979 tons), being 2·8 per cent.; and the beyond Europe trade shows an increase of 11,548 tons, of which due to dock 9,342 tons, being 13 0 per cent. The average tonnage of vessels frequenting the port has increased 8 per cent.; and of vessels loading in the South Dock 17·6 per cent. The increase of vessels above 500 tons, 54 in number, being 71·1 per cent. During the past month of June the total revenue amounted to 7,401*l.* 2*s.* 1½*d.*, 1,011 vessels having cleared from the port, and their register tonnage amounting to an aggregate of 171,814. 244,531 tons of coals were shipped during the month, of which quantity 133,756 were shipped in the South Dock.

Among new undertakings there are favourable accounts of the Cambois winning, belonging to the North Seaton Company. The men have sunk to

a depth of more than twenty-five fathoms without meeting any obstacle, and they are making rapid progress downwards. The new pit belonging to the Seaton Delaval Company, under the management of Mr. T. E. Forster, promises to be one of the largest in the trade, and it will be conducted on the most advanced scientific principles. The completion of this pit adds another to the eight existing shafts at the Seaton Delaval Colliery. At the Sleekburn new winning, belonging to the Bedlington Coal Company, the sinkers have succeeded in reaching the Low Main Seam, which is nearly six feet thick. Mr. Coulson superintended the work, his resident foreman being George Emmerson, and it was while working here that the Hartley accident occurred, and their services were called into requisition. The sinking has been a troublesome one, the stratification in some places being exceedingly soft, so much so, that at one time five sets of pumps were required to keep the water under. The depth of the pit is about 120 fathoms, and it will be worked on an extensive scale.

CUMBERLAND.—After many years of fruitless effort, coal has at length been discovered upon the Netherby estate at a distance of about two miles from the North British Railway. It has always been considered that a bed of coal, corresponding with that of the Cannobie field, must underlie a great part, if not the whole, of the Netherby estate, and attempts have been made at various times during a long series of years to discover a point favourable for sinking. Numerous pits have been worked in different places, but these were inferior seams, lying near the surface, and were only wrought fitfully by men of small capital. One of the earliest, if not the earliest, known attempt to find the superior coal was made by the present Earl of Derby, then Lord Stanley. During the period of his political intimacy with the late Sir James Graham, his lordship was a frequent guest at Netherby, and his experience of mining in Lancashire led him to the conviction that if proper search were made the coveted treasure would be found. His lordship undertook to bring scientific men from his own pits, to make investigations into the geological features of the district. Examinations and experiments were made, but nothing came of their labours. From that time, investigations on an extensive scale ceased to be made until the projected line from Hawick to Carlisle rendered the discovery of coal in that locality a matter of very great importance. Several borings were effected, but without result. At last means were found by a company, within the last twelve months, for still further prosecuting the search, and the management of the affair was placed in the hands of Mr. Gibsone, formerly manager of the Duke of Buccleuch's Cannobie Pits, who had a few years ago made a report to Sir James Graham upon the geological features of his estate, and who, in fact, has had more or less to do with all the recent searches for coal. After various trials, that gentleman succeeded a few days ago in discovering, in the township of Solport, a fine seam of coal about six feet thick, lying at the very moderate depth of thirty-four fathoms from the surface. The samples obtained by the bore prove the coal to be equal to the Newcastle coking coal, quite clean, and of excellent quality. Of the importance of this discovery it is unnecessary to say much. To the immediate district, as well as to the North British Railway, and the Silloth Railway and dock, the discovery of coal on the Netherby estate must be attended with great advantages.

It is said that the Messrs. Thompson, of Kirkhouse, lessees of the Earl of Carlisle's Haworth Coal Mines, have recently received the Admiralty certificate for their steam coal; having been tested by several of her Majesty's steam vessels at Portsmouth, and found of good quality, it has been added to the list of naval contracts. This being the only steam coal on the west coast, north of Cardiff, it may be expected to be largely exported.

LANCASHIRE.—The following statistics of the exports of coal, cannel, coke, and patent fuel (in tons), from the port of Liverpool to foreign parts

during the month of July, are extracted from J. and J. Platt's Export Circular of the 1st August.—*Coal*: Adelaide, 69; Aden, 1,485; Alicante, 266; Ancona, 100; Antigua, 34; Bahia, 432; Barcelona, 486; Bathurst, N.B., 60; Bilboa, 304; Bombay, 1,280; Bordeaux, 1,140; Buenos Ayres, 134; Cadiz, 285; Calcutta, 336; Cape of Good Hope, 300; Cape Town, 206; Cardenas, 107; Cartagena, 45; Ceara, 60; Charlotte Town, 27; Constantinople, 1,064; Corfu, 765; Curaçoa, 77; Dantzic, 50; Demerara, 326; Genoa, 930; Havana, 310; Iceland, 58; Jamaica, 98; Kingston (Jam.), 300; Kustendji, 323; Leghorn, 80; Lima, 117; Lisbon, 726; Madras, 244; Malta, 74; Malaga, 75; Matanzas, 247; Monte Video, 5; Montreal, 872; Nantes, 561; Nassau, N.P., 50; New York, 4,453; Odessa, 638; Oporto, 420; Pernambuco, 462; Quebec, 3,160; Queensland, 260; San Francisco, 40; Santa Cruz (Teneriffe), 610; Santos, 40; Sedashegur, 95; Singapore, 1,172; St. Jago de Cuba, 375; St. John's, N.B., 1,092; St. Nazaire, 186; St. Thomas, 1,732; Valparaiso, 2,327; Vera Cruz, 320; Victoria, V.I., 393.—*Cannel*: Bangor (Maine), 346; Boston, 710; Buenos Ayres, 1,099; Cape Town, 25; Cardenas, 134; Cronstadt, 134; Genoa, 390; Hong Kong, 42; New York, 13,978; Rio de Janeiro, 1,322; *Coke*: Adelaide, 6; Bahia, 10; Bombay, 1,123; Calcutta, 300; Constantinople, 35; Monte Video, 30; Montreal, 105; Sedashegur, 5; Valparaiso, 150; *Patent Fuel*: Callao, 50; Sedashegur, 10.—Totals: Coal, 32,283; cannel, 18,180; coke, 1,764; patent fuel, 60.—The exports of coal coastwise from the port of Liverpool, during the same month, were as follows:—Aberayon, 8; Aberdovey, 24; Abergele, 50; Aberporth, 49; Abersoch, 6; Aberystwith, 30; Amlwch, 123, ditto, coke, 10; Ballina, 37; Ballymoney, 80; Ballyshannon, 105; Barmouth, 135; Beaumaris, 65; Belfast, 455; Bray, 115; Bulloch, 381; Carnarvon, 92; Cemaes, 94; Clare. 140; Clontarf, 55; Cork, 158; Conway, 8, ditto, slack, 40; Courtown, 185; Dingle, 169; Dublin, 1,353; Dulas, 23; Dundalk, 13; Fort Stewart, 115; Holyhead, 210; Isle of Man, 41; Kingstown, 495; Larne, 50; Letterkenny (slack), 68; Limerick and Tralee, 94; Llandudno, 97; Llanhairn, 96; Loch Carran, 20; Mochras, 14; Mortora, 18; Nevin, 30; Newry, 330; Port Dinorwic, 120; Port Madoc, 366; Port Rush, 41; Portinllaen, 174; Pwllheli, 55; Ramsey, 55; Rathmullen, 35; Red Wharf, 237; Wexford, 50, ditto, coke, 10; Youghal, 190.—Total, 7,014.

SCOTLAND.

It was not until the middle of the month that the Scotch pig-iron market began to show symptoms of recovery from the depression which characterised the month of June. A gradual decline brought shipping orders more plentifully, and the tone became steadier. The following are the statistics of the export of pig-iron for the first seven months of the year:—

Month ending.	1862.	1861.	1860.
	Tons.	Tons.	Tons.
January 26	34,812	31,519	32,454
February 22	38,627	29,738	25,278
March 29	55,399	42,554	46,928
April 26	53,160	62,622	50,585
May 31	70,461	82,036	66,701
June 28	42,167	57,201	40,712
July 26	41,581	48,304	47,846
Total	336,207	353,974	310,504

The Glasgow coal trade has not altered much one way or the other. The collieries are in an unsettled state, and a general demand for high wages is not improbable. The exports for July were 51,000 tons against 62,749 tons in the corresponding month of last year. The lock-out and strike still continue, and each party only seems to grow more determined. Large numbers of the men continue to find employment elsewhere, and funds are being collected for those who remain while they continue on the ground. It is to be hoped this unhappy dispute will soon be amicably arranged.

In the vicinity of Croy Railway Station, a new iron-stone field belonging to Messrs. Baird, is being opened up; one or two of the pits sunk will be among the deepest in Scotland.

The Clyde iron-works belonging to Messrs. Dunlop were closed on August 21st. The number of furnaces in blast had been reduced to two some time previously. The total number now out is five.

THE CONTINENT.

FRANCE.—Notwithstanding the complaints put forth as to the present position of metallurgy in France, it must not be inferred that all the establishments of that country are in a hopeless state; on the contrary, many works are in full prosperity, and will make without boasting a pretty good year. Thus, in the Berry district, metallurgy seems the only industry prospering. The department of the Cher now comprises twenty-five blast furnaces, and of these twenty-two are in activity, sixteen working exclusively with charcoal. The position of the group is expected to improve still further, as Bourges, by reason of its proximity to the collieries of Montlucon, and the works of Vierzon, Commentry, and Fourchambault, and the forges and foundries of Nevers, Guerigny, and Cosne, is to be made the great arsenal of the French Empire. In the north of France also there is activity. The Maubenge, Providence, and Esperance establishments (rolling works these last), and the forges of the department of the Nord have plenty of work on hand. These establishments can produce iron very advantageously, as they draw from Belgium pig paying a duty of only 2*s.* per ton, while rolled foreign irons cannot enter into competition with others in the French market without paying a duty of 5*s.* 6*d.* per ton. In the Moselle district the forges of Hayange have excellent conditions of production, equal in every point of view to those of the Belgian works; the establishment produces rails at a lower rate than any other in France, and is consequently the most redoubtable competitor met with by importers of foreign irons. The iron trade of the Haute-Marne district continues in a drooping state, prices shewing a tendency to fall rather than rise. At St. Dizier, disposable pig has been quoted at 5*l.* 8*s.* per ton. Forged irons have experienced a slight fall, bars being quoted 11*l.* 4*s.*, and axles 12*l.* per ton. There has been no change in wire or in machine or rolled irons. The unsatisfactory condition of the trade of the Haute-Marne district may be attributed to the maintenance of a system of making with wood, which is not suited to the present day.

Some interesting returns have just been made up, which afford valuable information with respect to the quantities of coal, iron, &c., imported into France during the first half of 1862, 1861, 1860. The totals stand thus for each year :—

	1862.	1861.	1860.
	Tons.	Tons.	Tons.
English pig	88,403	38,477	7,553
Belgian ditto	1,811	1,573	4,553
Miscellaneous ditto	1,472	4,523	1,570
Belgian iron, in bars	8,640	—	—
English ditto	28,008	—	—
Miscellaneous ditto	720	727	173
Steel	958	266	201
Belgian coal	1,331,080	1,449,673	1,450,012
English ditto	679,463	804,134	507,084
German ditto..	326,703	385,332	357,182
Miscellaneous ditto	4,986	2,346	1,356
German coke	99,172	120,682	158,953
Belgian ditto	208,666	156,801	169,218
Miscellaneous ditto	2,846	2,444	268,171

England, so far as iron, pig, and steel are concerned, has evidently profited very largely by the recent treaty arrangements, the increase in the delivery of iron and pig being altogether extraordinary. The same cannot, however, be observed with respect to coal, although it cannot be said that England has suffered much more than Belgium, France having become less dependant upon her neighbours than formerly for her supply of combustible.

The Montigny-sur Sambre Blast Furnace and Rolling Works' Company has issued its annual Report. The details show, that for the year ending April, the company realized a profit of 4,094*l.* against 6,585*l.* in corresponding months of 1860-61. Various causes have been at work to reduce the profits. The price of iron in bars has been affected by the competition induced by the establishment of new works; rails have fallen but coals have not gone down in the same proportion. But shareholders must be consoled by observing that the company is in a position to increase its make, and to profit largely from a return of business activity whenever it may occur.

A sale of blast furnaces, foundries, &c., at Pont-a-Mousson, in the department of Meurthe, on September 1st, there are three blast furnaces and every accessory, and also the exclusive right of working the mine which feeds the furnaces, and is situated between 8 and 9 miles from Pont-a-Mousson. The property is offered at the upset price of 24,000*l.* to begin with; it is well supplied with railway communication not only with France, but with Belgium and Germany.

The French will acquire quite a celebrity for iron bridges. The Orleans Company is now engaged in throwing one over the left bank of the Scorff, an arm of the sea which forms with the Blavet, the port of Lorient. The bridge will have a length of 1,100 feet, and will be composed of ten arches in masonry, and three spans comprising altogether 576 feet. The metallic part will be supported by two piers, established on a rocky foundation, at a depth of sixty feet below the ordinary tides. When this great work is completed, the first portion of the Nantes and Brest Railway (that is, as far as Lorient) will be in a position to be opened for traffic.

Belgium.—The iron trade of this country seems to be going on much the same as usual. Sales of pig are concluded very readily, but on terms which yield only a single profit. Ordinary refined pig has been done at 3*l.* 2*s.* per ton. Belgian ironmasters are not considered to be suffering much from the present uneasy condition of commercial affairs, as they seek to reduce their cost of make by establishing their production on larger bases. The Chatelineau Company has just increased its rolling works in

order to produce on a large scale special irons, such as rails, girders, and iron plates of as much as 1½ inch in thickness. Messrs. Dumont and Co. have completed their rolling works, near the new station at Chatelineau, comprising six puddling furnaces. The rolling works of the Gallez Company have been in activity about two months and are delivering sheets; while the rolling works of De Dorlodat Brothers, which can produce upwards of 2,000 tons of rails monthly, are about to be extended, with a view to the manufacture of other descriptions of iron. The Corvillet and Thyle chateau blast furnace have concluded a contract of 8,000 tons of rails, to be delivered to the Loman system of railways.

AUSTRIA.—The following statistics are interesting as showing the difference between the rates levied by the Austrian tariff and that of France on some of the principal articles of British produce imported into those countries:—

	Austrian Import Duties.				French Tariff.		
	£	s.	d.		£	s.	d.
Coals, per 110¼ lbs.	free			ton	0	1	2
Lead, sheets	0	10	2	cwt.	0	2	0½
„ pig, (by sea)	0	5	0	..	0	1	3
Iron, cast „	0	2	0	..	0	1	0¼
„ bars, rails, and tires (by sea)	0	5	1	..	0	2	10
„ sheets, black	0	8	0	..	0	3	5½
„ tin plates	0	10	0	..	0	6	6
„ wire	0	10	1	..	0	5	8¼
„ steel, raw, in plate and bars above ¼-inch ..	0	8	0	..	0	6	1
„ wire, rough	0	15	0	..	0	12	2¼
Cast-iron wares, not polished	0	4	0	..	0	1	5¼
Iron chips, per ton	0	8	0	ton	2	16	0

COLONIAL.

CANADA.—The miners are now drilling a bore hole in the Burt mountain, belonging to the Lake Superior Company, for blasting purposes, which is intended to be from 36 to 40 feet deep, and 6 inches in diameter. When finished an immense quantity of powder will be inserted, and a slow match applied, the effect of which will be to throw down nearly the whole side of the mountain. The labour required to bring about this result will be better understood when it is known that the bore hole is being drilled through almost pure iron. The oil business is in a healthier state than for some time past, prices ruling firm with an upward tendency.

NEW SOUTH WALES.—A new coal seam has been proved and worked at Bellambi. It is a lower coal seam which until now has been supposed to be inferior to the only one worked either at Bellambi or Wollongo, It is a large seam from 9 to 10 feet in thickness. The coal is fine and bright, with much more gas and bitumen than the coal in the upper seam, which is about 100 feet perpendicularly above it. It is a very free burning coal for household purposes, and will also be advantageous to mix for steam purposes with the upper coal when the furnace draught may not be so good on board steamers. This is good news for the district, as it gives a very much larger area of coal land than it possessed in the upper seams only, and a very agreeable diversity in the character of the coal.

SOUTH AUSTRALIA.—The advices received are favourable with respect to the progress of mining. Bon Accord is going on well; sixteen hands are at present employed, and a 24 fathom level has been driven 12 fathoms from Jeffrey's shaft, where they expect to intersect a good lode. The Great Northern Mines are reported to be making good progress in their operations. Mr. Bonny had left Adelaide to inspect some mineral sections adjoining the Yudanamutana Mines, in the hope of securing them for the Great Northern Company. The Yudanamutana, it is said, will yield ore in

quantities. At one of their mines (the Blinman) twenty-seven men have been set to work; they are cutting down the lode, 5 feet wide, with rich ore, and had already raised 20 tons, worth 35 per cent. for copper; they are quarrying rocks of several tons weight, worth 30 or 40 per cent. Copper had declined 2*l.* per ton. Burra Burra shares were depressed.

A limited liability company, called the *Spring Creek Copper Mining Company*, with a capital of 100,000*l.*, in 20,000 shares of 5*l.* each, is advertised. Its object is stated to be the acquiring and working of the property known as the "Spring Creek Mine" near Port Augusta. It is said that position of the lode discovered, from which samples have been sent for assay, renders machinery, at all events, probably for some time, unnecessary. They suppose that in this instance cartage to the shipping port, which is frequently an obstacle to the working of mines in the colony, will not interfere, as it is said that 30*s.* a ton will cover the expense of conveying the ore to Port Augusta where it will be shipped for England or elsewhere.

NEW ZEALAND.—The *Nelson Examiner* says:—The prospect of a large coal trade for us is encouraging. The superintendent and party, who have been absent for several weeks on a visit to the West Coast, returned on Thursday evening last, and the accounts they have brought of the quality of the coal at the Buller, and the extent of the seam, show it to be more valuable than that at the Grey, while it has the advantages of being much nearer to us, and the river more accessible. Nearer home, a tramway is about to be laid between the mine at Pakawau and the harbour, which will enable coal to be shipped to Nelson at a moderate cost; and the vessel that has taken over to Pakawau the plant for the tramway, is to return with five tons of plumbago, which will serve as a sufficient sample of that mineral.

Metal Markets.

THE following weekly reports from Messrs. Von Dadelszen and North, show the position of the metal market during the month:—

July 23rd.—COPPER.—The smelters adhere firmly to fixed quotations, both for raw and manufactured, and only in exceptional cases second-hand parcels are obtainable a trifle under official prices. Foreign has been rather quiet, and business curtailed. We quote both Burra and Kapunda 95*l.*; Spanish, 90*l.*; Chili, 86*l.*

TIN.—English unchanged in price, and in but moderate demand. A fair amount of business has been done in Straits, at 113*l.* cash, and with full prompt (three months;) Banca, 115*l.* 10*s.* to 116*l.*, but very quiet. The Dutch market is steady at 68 f.

TIN-PLATES.—The manufacturers are working off old contracts, while buyers are very cautious in entering into fresh engagements, through the adverse news from New York, both as regards increased duty and advancing exchange.

LEAD is still depressed, and difficult of sale.

SPELTER.—A large amount of business has been done, principally for forward delivery in Hull, at 18*l.* 5*s.* per ton, and we quote spot parcels, favourite brands, the same price. But little business has been done in spelter in warehouse, which is obtainable at 18*l.*

July 30th.—The Metal Market has been very quiet, and were it not for the cheapness of money, we do not think prices could have been so well maintained. The almost prohibitive tariff from America which will come in force on the 1st of August next, causes a cessation of shipments to that quarter.

COPPER.—The market has become very quiet, and manufactured is now obtainable a trifle under official quotations, the demand, however, is very slack. Tough cake and ingot 92*l.* to 93*l.*; Burra is now obtainable at 94*l.*, and Kapunda is quoted 95*l.* nominally; Spanish 89*l.*, and Chili 86*l.*

TIN.—English unaltered in value, and parcels are obtainable under market price; we cannot report any business of importance in Straits, which remains at 113*l.* cash and with three months prompt; while Banca is quite neglected, and is quoted nominally 115*l.* to 116*l.* The Dutch Market is dull, at 67¾f.

TIN PLATES.—Hardly any business has been done, and prices remain steady. We quote charcoal from 26*s.* to 28*s.*, according to quality; and cokes from 21*s.* to 23*s.*, in Liverpool.

LEAD is difficult of sale, and prices tending downwards.

SPELTER.—It is difficult to meet with buyers, and we quote on the spot here 18*l.* Hull parcels could be placed at 18*l.*, but holders are not disposed to sell under 18*l.* 2*s.* 6*d.* to 18*l.* 5*s.* WH, 18*l.* 15*s.*

August 6th.—During the last fortnight much less business has been done, and some kind of metals show a tendency to decline, in spite of the increasing cheapness of money, and the prospects of a good harvest. There is a great absence of speculation. The new American tariff which came into force on the first of this month, will materially curtail exports. Trade is decidedly stagnant.

IRON.—Welsh bars have been in fair demand, and most makers adhere firmly to 5*l.* 5*s.* free on board in Wales, while from 5*l.* 17*s.* 6*d.* to 6*l.* is paid free on board here.

COPPER.—During the early portion of the month there was a good demand, principally for raw copper, and full prices had to be paid. Although the smelters asked 10½*d.* per lb. for manufactured, we heard of but few instances where this price was paid. For the last ten days, the market has become easier, and cake, tile, and ingot, can be bought under fixed prices, while manufactured is obtainable at 10¼*d.*; the demand, however, is very light. Foreign has followed the course of English.

TIN.—Business has been of the most insignificant character, consumers only buying for their most pressing wants, and prices are with difficulty maintained. The effect of the new tariff of America must have an important influence on this metal. On Tuesday the smelters reduced English tin both common and refined, 3*l.* per ton.

In TIN PLATES prices are well maintained.

LEAD.—The market has been very dull, and but little business has been done, prices tending downward; we quote good soft English pig from 19*l.* 15*s.* to 20*l.*, up to 21*l.* for W. B.

SPELTER.—A good amount of business has been done, principally in Hull parcels on the spot and for forward delivery, the former from 18*l.* to 18*l.* 5*s.*, according to brands, and the latter mostly at 18*l.* 5*s.*

August 13th.—There are no signs of improvement in the metal market, and complaints are becoming general about slackness of trade. It is only with the greatest difficulty that present prices are maintained.

IRON.—Welsh bars continue in moderate demand at 5*l.* 5*s.* at the works, and from 5*l.* 17*s.* 6*d.* to 6*l.* f.o.b. here. Staffordshire unaltered. A large speculative business has been done in Scotch pig iron, but the advance is confined to 3*d.* per ton since our last report; the present price 53*s.* 3*d.* cash.

COPPER.—English is quiet. English manufactured from 10¼ to 10½ according to speculation. Tough cake and ingot from 91*l.* to 93*l.*, according to quality. Business in foreign restricted. Burra, 94*l.* to 95*l.*; Kapunda, 95*l.*; Spanish, 80*l.* to 90*l.*; Chili, 96*l.*

TIN.—Since the reduction there has been a fair demand in English, while in foreign hardly any business has been done here. We have sellers

of Straits at 111*l.*, buyers limited 110*l.* Banca 114*l.* 10*s.* nominally. The Dutch market has fallen to 66½-¼ f.

TIN PLATES.—Manufacturers adhere to previous quotations, but the demand is slack, and it will be difficult to maintain present prices.

LEAD is dull; good soft English can be bought at 19*l.* 15*s.*

SPELTER.—Hardly any business has been done; the tendency of prices is in favour of buyers. We quote spot here from 17*l.* 17*s.* 6*d.* to 18*l.* Hull parcels according to quality, 18*l.* to 18*l.* 2*s.* 6*d.* WH 18*l.* 10*s.* to 18*l.* 15*s.*

August 20th.—We have to report a more animated market, in nearly every description of metals, since our last.

COPPER.—A very much better tone is manifested, and prices tend upwards. Second-hand parcels of English are difficult to be met with, and smelters are unwilling to submit to any reduction upon official prices. Raw in demand at full price. Business in foreign is quiet, from sellers being stiff. Burra, 95*l.*; Kapunda, 95*l.* to 96*l.*; Spanish, 89*l.* to 90*l.*; Chili, 96*l.*

TIN.—English continues in fair demand, and within the last day or two, we have had more inquiry for foreign. Straits after ruling at 110*l.* has sold at 110*l.* 10*s.*, and is now firm at 111*l.*, both for cash, and three months prompt. Banca, 115*l.* The Dutch market has improved to 67f.

TIN PLATES.—There is a limited demand, still manufacturers adhere to previous quotations. Lead is dull—good soft English is obtainable at 19*l.* 15*s.*

SPELTER.—Hardly any business has been done, and the tendency of prices is in favour of buyers. We quote on the spot here, 17*l.* 17*s.* 6*d.* to 18*l.* Hull parcels according to quality, 18*l.* to 18*l.* 2*s.* 6*d.* W.H. 18*l.* 10*s.* to 18*l.* 15*s.*

Metallic-Ore Markets.

TIN.—The standard for black tin remains unaltered at—

Refined	£102—6
Common	101

The market still continues very dull, although there has been no reduction in the standard.

COPPER.—At the four Cornish sales we give this month, the number of tons, average produce, quantity of fine copper, average price per ton, and standard, have been as follows:—

Date.	*Tons.*	*Produce.*	*Fine Copper.* Tons. cwt.	*Price per ton.*	*Standard.*
July 24.	2,990	7	209 6	£5 9 6	£117 7 0
„ 31.	4,671	6½	302 4	5 1 0	120 11 0
Aug. 7.	2,557	6¼	165 9	5 1 6	121 0 0
„ 21.	5,007	6⅛	306 11	4 16 6	123 17 0

At the sale of the 24th the standard was stationary; at the sale of the 31st according to the *West Briton* the standard advanced 1*l.*, but according to the *Mining Journal* only 10*s.*; at the sale of August 7th the standard advanced 15*s.* according to the *West Briton*, but only 9*s.* according to the *Mining Journal.* There was no sale on the 14th; at the sale of the 21st according to the *Mining Journal* the standard advanced 6*s.*, according to the *West Briton* it advanced slightly.

It is satisfactory to observe that since the sale of the 24th the standard has advanced steadily although slightly. The total advance during the month has been rather more than 25*s*.

LEAD.—Comparing the scales of lead ore for the month with those of last month there has been a decided advance in price, on an average of about 10*s*. per ton of ore, amounting in the case of Minera to about 20*s*. per ton.

London Share-Market.

DURING the month the dealings in mining shares have been on a much more restricted scale than for some time past. Prices have been tolerably stationary with the exception of Ludcott and East Carn Brea, the former having fallen fully one-half, and the latter several pounds per share. In neither instance has the fall been recovered; and the collapse in Ludcott has brought about a state of feeling in the market that can only be fairly described as that of utter prostration. The wild speculation that characterized the early portion of the month has been followed by a calm, in which it has become an almost impossibility to deal. The general business must therefore be pronounced unsatisfactory. At the final close, more favourable symptoms are manifest; prices have somewhat recovered, and more business is being transacted.

The cause of the dullness of the market is partly to be found in the absence of the dealers on holiday excursions, but principally in the ruin that has followed the inordinate speculation in Ludcott shares, which has served to drive out of this field of investment a large body of its best friends. Irrespective of these causes the condition of things generally are such as should favour mining investments: money is cheap and the markets for metals have been decidedly stronger.

In mines *per se* no discoveries of importance have been made. Those showing signs of improvement are South Caradon, Devon Great Consols. West Seton, Wheal Seton, East Caradon, East Carn Brea, North Crofty, and North Roskear. But in several other of the old and established mines points of interest are about being reached which may develope resources that will entirely change the aspect of, and throw new life into, the market for mining shares.

The important meetings of the month have been West Seton, where a dividend of 5*l*. per share was declared, Wheal Seton 2*l*., Dolcoath 7*l*., Botallack 2*l*., Providence 1*l*., and Clifford Amalgamated 6*s*. At East Carn Brea meeting the accounts showed a credit balance, including an ore bill due in September of 3,147*l*.

Share transactions have been on a very limited scale, having been mostly, for the reasons stated, confined to Devon Great Consols, South Caradon, East Caradon, Marke Valley, Wheal Seton, Great Fortune, Cook's Kitchen, East Carn Brea, Ludcott, Grenville, North Crofty, North Roskear, West Tolgus, and a few others.

North Crofty Shares are inquired for at 4*l*. consequent on an improvement in the lode, in the 150 fathom level, which is now worth

60*l*. per fathom while the 170 is worth 20*l*. North Rosskears have risen to 26*l*. buyers: the lode in the 184 west of Paull's Shaft is worth for copper 50*l*. per fathom. East Caradon 47¼ ¾*l*.: these shares have been remarkably steady all the month, and it being expected that the caunter lode will be cut at the 70 within a day or two, the attention of investors and speculators are alike turned with interest towards it.

East Carn Brea shares fell to 10*l*., but have recovered to 12*l*. with an upward tendency. The sampling of 468 tons of ore is in excess of that computed, and the quality of the ore is also better than the last sale, the assay giving a produce of 8¼ per cent. of copper, and the parcels expected to realize upwards of 3,000*l*.

Wheal Union shares are steady at 4½-¾. The lode in the shaft is producing fine rocks of ore and manifesting symptoms of an early development of a course of ore. South Tolgus has improved in the bottom levels. West Tolgus is opening up a good mine. Grenville and East Grenville are both inquired for at higher quotations. North Downs are flat at 3*l*. South Frances shares are offered at 100*l*. without finding buyers. Cook's Kitchen shares fell to 27*l*., but have since risen to 29*l*. Great Fortune rose to 30*l*., fell to 26*l*., and finally close 27*l*. buyers. Tincroft's are flatter at 10½. Margaret's and Providence find buyers at 42*l*. and 41*l*. respectively.

In lead mines, Trelawneys have risen suddenly to 18*l*., at which price they close firm, after having been down to 15*l*. sellers.

Bryn Gwiogs, after remaining unsaleable at 23*l*., suddenly sprung into favour at 26*l*. buyers.

Billins' shares have advanced to 16*l*., and Long Rake to 17*l*.

In Foreign mines, the chief business has been in St. John del Rey shares, which are flatter at 56. Santa Barbara at 10*s*. premium. Quebrada, ½ dis. to par: this latter company is likely to take a prominent position.

Saturday, August 30th, 1862.

The following are the closing prices of mining shares this day:—

Bryn Gwiog, 25 to 27; Caradon Consols, 16 to 17; Cook's Kitchen, 28 to 29; Devon Great Consols, 450 to 460; Drake Walls, 19*s*. to 1*l*. 1*s*. East Basset, 46 to 48; East Caradon, 47½ to 48; East Carn Brea, 11¾ to 12; East Rosewarne, 2⅝ to 2¾; East Wheal Grenville, 2½ to 2⅝; East Wheal Russell, 3 to 3⅛; Grambler and St. Aubyn, 16 to 17; Great South Tolgus, 3¾ to 4; Great Wheal Fortune, 26½ to 27½; Herodsfoot, 42 to 43. Hingston Downs Consols, 2¾ to 3; Long Rake, 16½ to 17½; Marke Valley, 10½ to 10¾; New Wheal Seton, 95 to 100; North Downs, 3 to 3¼; North Roskear, 25 to 26; North Treskerby, 27 to 28; North Wheal Basset, 3 to 3⅛; North Wheal Crofty, 3⅛ to 4⅛; North Wheal Robert, 1 to 1⅛; Pendeen Consols, 3½ to 4; Providence, 41 to 42; Rosewall Hill and Ransome United, 4⅛ to 4⅜; South Caradon, 340 to 350; South Carn Brea, 2½ to 2¾; South Tolgus, 35 to 40; South Wheal Frances, 100 to 102½; Stray Park, 30 to 31; Tincroft, 10½ to 10¾; West Caradon, 30 to 32; West Condurrow, 4 to 4½; West Wheal Seton, 235 to 245; Wheal Basset, 85 to 87½; Wheal Clifford, 23 to 24; Wheal Grenville, 5¾ to 6; Wheal Grylls, 24 to 26; Wheal Kitty (Lelant), 10½ to 11; Wheal Ludcott, 10¾ to 11; Wheal Margaret, 42 to 43; Wheal Mary Ann, 15½ to 16½; Wheal Seton, 144 to 146; Wheal Trelawney, 17½ to 18; Wheal Unity Consols, 16 to 18; Wheal Uny, 6¾ to 7.

Provincial Share Market.

Dublin.—The following report is condensed from the *Mining Journal:*

Towards the latter part of July, mining shares were comparatively neglected. Mining Company of Ireland shares done at 17*l*. 7*s*. 6*d*., or an advance of 7*s*. 6*d*. Wicklow Copper shares firm at their recent sudden rise of 2*l*. 15*s*. each, and enquired for at 39*l*. 10*s*.; sellers at 40*l*. Connorree shares steady at 28*s*., and General Mining Company for Ireland at 5*l*., ex new. Castleward Lead Mine shares dropped to 5*s*. discount, on sale at 15*s*. Carysfort shares weak, and fully paid-up ones (of 2*l*. 10*s*,) were procurable at 31*s*., but since it has become known that a rib of lead, 3 inches thick, has been met with at Ballintemple Mine, in the lode cut in the cross-cut for a 30 fm. level, or 10 fms. under the level in which a good length of orey ground has been opened, these shares have been in better request, and those of 2*l*. 10*s*. paid find buyers at 33*s*.. and the 1*l*. shares at 18*s*.

At the end of the month dividend-paying mines were in better demand. Wicklow Copper shares made a further advance of 2*l*. 5*s*. per share, making a rise of 5*l*., or about 10½ per cent., within a fortnight, with every prospect of keeping firm, and a fair chance of going still higher: enquired for at 42*l*., sellers demanding 42*l*. 5*s*. Mining Company of Ireland shares also rose, and in demand at 18*l*. 10*s*., or an advance of 1*l*. 2*s*. 6*d*. on last quotation. For forward delivery a considerably higher price looked for. Connorree shares receded 2*s*. per share, and were offered at 26*s*.; and General Mining Company for Ireland shares procurable at a reduction of 2*s*. 6*d*. on the last quotation, or at 4*l*. 17*s*. 6*d*. Carysfort shares heavy at last rates.

At the beginning of August a fair average amount of business was done. There were many inquiries for Wicklow Copper shares, but a reduction was asked on the recent great rise in them, to which holders refused to submit; they remained, therefore, at last quotation. Mining Company of Ireland shares gave way 5*s*.; all that could be procured at 18*l*. 7*s*. 6*d*. were bought, and none were to be had under 18*l*. 10*s*. General Mines for Ireland dull; sellers prevailing at 4*l*. 15*s*., but none changed hands. Connorree shares also on sale at last rate of 26*s*. Carysfort Mining Company's shares, fully (2*l*. 10*s*.) paid, were bought at 31*s*., and inquired for at that price; the shares of 20*s*. paid were bought at 16*s*.

In the middle of the month mining shares were in active request. Wicklow Copper shares largely dealt in at the last quotation of 42*l*., which was maintained, without variation, for cash or forward account. Mining Company of Ireland shares were at first rather weak, having receded at one time to 18*l*. 5*s*., but they recovered, and were in fair demand at 18*l*. 7*s*. 6*d*. General Mines improved, and changed hands at 5*l*. per share. Connorree shares advanced from 26*s*. to 28*s*., but fell, and were on sale at 26*s*. 6*d*. Carysfort Mining Company shares fiat, and on sale at 16*s*. (20*s*. paid), and at 32*s*. (2*l*. 10*s*. paid).

Towards the end of the month Wicklow Copper Mining Company's shares were inquired for, but holders not being willing to make concessions on the last rise, transactions were limited, and closed at last rates, of 42*l*. The shares of the Mining Company of Ireland changed hands more freely at slight fluctuations, but maintained on the whole, last quotations of 18*l*. 7*s*. 6*d*. General Mining Company's Shares last weaker, business done at 4*l*. 17*s*. 6*d*., or ⅛th under last price, and on sale. Connorree and Carysfort shares flat, the former on sale at 26*s*., and the latter falling (on 2*l*. 10*s*. paid) to 30*s*.

Tabular Abstract of Mining Accounts for the Month.

Date of Meeting.	Name of Mine, and Number of Shares.	Balances.		Calls.		Dividends.	
		Debit.	Credit.	Per Share.	Total.	Per Share.	Total.
		£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
	CORNISH AND DEVON MINES.						
July 18	Frank Mills (5,000)	—	1,543 11 10	—	—	—	—
" 21	Wheal Trannack (512)	—	22 6 0	0 5 0	128 0 0	—	—
" 23	West Basset (6,000)	—	2,529 7 9	—	—	0 8 0	2,400 0 0
" 23	South Gorland (950)	99 8 2	—	0 10 0	475 0 0	—	—
" 23	Redmoor (11,789)	569 3 11	—	0 1 0	589 9 0	—	—
" 23	Wheal Crebor (6,000)	36 13 11	—	0 1 0	300 0 0	—	—
" 23	West Wheal Jane (10,000)	—	—	0 2 6	1,250 0 0	—	—
" 23	Wheal Agar (6,000)	280 15 8	—	—	—	—	—
" 23	Wheal Sidney (4,096)	1,620 15 2½	—	0 5 0	1,024 0 0	—	—
" 24	Treworlis (2,048)	687 5 1	—	0 7 4	716 16 0	—	—
" 24	Lady Bertha (6,000)	1,396 4 3	—	0 4 0	1,200 0 0	—	—
" 24	Caradon Hill (4,096)	165 3 9	—	0 5 0	1,024 0 0	—	—
" 25	Devon Consols (1,024)	—	33,382 5 0	—	—	9 0 0	9,216 0 0
" 25	Wheal Edward (4,096)	—	160 16 7	0 2 6	512 0 0	—	—
" 29	East Basset (512)	—	1,580 19 11	—	—	2 0 0	1,024 0 0
" 29	Great Wheal Baddern (3,730)	796 10 0	—	—	—	—	—
" 30	Great Wheal Fortune (1,798)	—	1,869 11 1	—	—	0 10 0	899 0 0
" 30	New South Caradon (6,000)	108 9 5	—	0 1 6	450 0 0	—	—
" 31	Gonamena (6,144)	23 14 11	—	0 2 0	614 8 0	—	—
" 31	Craddock Moor (1,055)	—	1,342 15 7	—	—	0 4 0	211 0 0
" 31	East Wheal Jane (6,145)	—	191 3 10	0 3 6	1,075 7 6	—	—
Aug. 1	Pednandrea (8,465)	834 5 2	—	0 2 0	846 10 0	—	—
" 5	South Caradon (512)	—	5,350 2 9	—	—	5 0 0	2,560 0 0
" 5	Wheal Basset (512)	—	2,373 0 9	—	—	2 0 0	1,024 0 0
" 5	South Basset (512)	614 1 11	—	1 5 0	640 0 0	—	—
" 6	East Grenville (6,000)	935 17 10	—	0 2 6	750 0 0	—	—
" 6	Holmbush (10,000)	—	138 6 2	—	—	—	—
" 6	East Trefusis (1,000)	627 3 4	—	1 0 0	1,000 0 0	—	—
" 7	South Seton (400)	497 17 0	—	2 10 0	1,000 0 0	—	—
" 7	Calvadnack (915)	1,266 12 10	—	1 0 0	915 0 0	—	—
" 8	R. Tamer Mining Co. (10,000)	—	599 10 1	—	—	—	—
" 11	Dolcoath (358)	—	3,182 10 3	—	—	7 0 0	2,506 0 0
" 11	Wheal Seton (396)	—	1,921 7 7	—	—	2 0 0	792 0 0
" 11	West Grylls (6,000)	219 2 9	—	0 2 6	750 0 0	—	—
" 12	West Seton (400)	—	2,644 15 9	—	—	5 0 0	2,000 0 0
" 12	North Wheal Robert (6,144)	—	250 13 7	—	—	—	—
" 13	West Caradon (1,024)	—	4,728 15 2	—	—	—	—
" 13	Wheal Sithney and Carnmeal (2,048)	953 5 7	—	0 10 0	1,024 0 0	—	—
" 13	South Dolcoath and Carmarthen (6,000)	256 7 9	—	0 2 0	600 0 0	—	—
" 14	Wheal Trelawny (1,040)	—	2,038 0 0	—	—	9 10 0	520 0 0
" 14	Wheal Unity Consols (6,000)	1,122 9 3	—	0 3 0	900 0 0	—	—
" 14	Great North Downs (6,000)	687 14 2	—	0 10 0	3,000 0 0	—	—
" 14	Great Brigan (5,000)	1,833 1 4	—	0 10 0	2,500 0 0	—	—
	WELSH MINES.						
July 22	Bryntail (20,000)	178 2 6	—	0 4 0	400 0 0	—	—
" 23	Bryn Gwiog (500)	—	242 0 0	—	—	—	—
" 23	South Bryn Gwiog (100)	104 7 2	—	1 0 0	100 0 0	—	—
" 23	Dyfngwm (3,000)	—	800 0 0	—	—	0 2 6	375 0 0
" 29	Clara United (4,000)	—	—	0 1 0	200 0 0	—	—
" 29	Merllyn (4,480)	88 1 2	—	0 0 6	112 0 0	—	—
" 29	Garreg (1,000)	242 1 8	—	0 3 0	150 0 0	—	—
Aug. 4	Deep Level (2,000)	—	499 11 4	—	—	—	—
" 6	Minera (1,800)	—	—	—	—	6 5 0	11,250 0 0
" 7	Penralt (6,000)	—	—	0 1 0	300 0 0	—	—
	FOREIGN MINES.						
July 28	Port Philip and Colonial (100,000)	—	4,080 11 5	—	—	0 1 0	5,000 0 0
" 28	Australian Mining Co. (20,000)	—	1,741 5 0	—	—	—	—
Aug. 1	Scottish Australian Mining Co. (20,000)	—	12,826 0 7	—	—	—	—

Prices Current of Metals.

From Messrs. James and Shakspeare's, 10, Austin Friars, E.C.

					Per Ton.
IRON	Bars	in Wales	£ ——	@	£5 5 0
	„	„ Liverpool	——		5 15 0
	„	„ London	6 0 0	„	6 5 0
	Nail Rods	„ Wales	5 12 6	„	5 15 0
	„	„ Liverpool	6 10 0	„	7 0 0
	„	„ London	6 15 0	„	7 0 0
	Hoops (Staffordshire)	„ Liverpool	7 15 0	„	8 0 0
	„ „	„ London	8 5 0	„	8 10 0
	Sheets „	„ Liverpool	8 10 0	„	9 5 0
	„ „	„ London	9 0 0	„	9 10 0
	Bars „	„ Liverpool	6 15 0	„	7 0 0
	„ „	„ London	7 2 6	„	7 5 0
	Scotch Pig (No. 1. g.m.b.)	the Clyde	——	„	2 16 0
	Rails	in Wales	——	„	5 15 0
	Russian	C.C.N.D.	——		——
	Swedish—Hammered—large sizes		——	„	11 5 0
	„ „ Indian sizes		11 15 0	„	12 0 0
STEEL	Hammered—faggot		——		15 10 0
	„ in kegs ⅛ and ⅝ in.		——		15 10 0
COPPER	Australian and other *fine* Foreign		——	„	96 0 0
	Foreign Slab, for Prod. 96 per Cent.		85 10 0	„	86 0 0
	English Tile and Tough		92 0 0	„	93 0 0
	„ Best selected		95 0 0	„	96 0 0
					Per lb.
	„ Sheets, Sheathing and Rod		——	„	10⅛*d.*
	„ Flat Bottoms		10¾*d.*	„	11*d.*
YELLOW METAL	Sheets, Sheathing and Rod		8¼*d.*	„	8¾*d.*
					Per Cwt.
TIN English	Common Blocks and Ingots		——		111*s.*
	„ Bars (in barrels)		——		112*s.*
	Refined		——		116*s.*
Foreign	Straits		——		113*s.*
	Banca		——		115*s.*
					Per Box.
TIN PLATES at Liverpool 6*d.* Less	Charcoal IC, best		28*s.*	„	29*s.*
	„ IX „		34*s.*	„	35*s.*
	Coke IC		22*s.*	„	23*s.* 6*d.*
	„ IX		28*s.*	„	29*s.* 6*d.*
					Per Ton.
LEAD	Sheet		——		21 0 0
	Pig—W.B.		21 5 0		21 10 0
	„ Ordinary brands		——		20 10 0
	„ Foreign, soft		——		19 10 0
	Red		——		21 10 0
	Shot		——		23 10 0
	Dry White		——		27 10 0
SPELTER	(Cake)		——		18 0 0
ZINC	(Sheet)		——		23 10 0
					Per Bottle.
QUICKSILVER	(in bottles containing 75lbs. each)		——		7 0 0
					Per Ton.
REGULUS OF ANTIMONY	French Star		43 0 0		43 10 0

There has been an improvement in the Metal Market during the last week or ten days.

IRON.—A strong speculative demand has caused an advance in *Scotch Pig*.

COPPER.—There has been more enquiry for all descriptions, and smelters now ask full prices for *English*. In *Foreign* there have been numerous transactions, and the quotation for *fine* sorts is nominal, as holders do not seem inclined to name a price.

TIN.—A good demand for *English* and *Straits*; in the latter several hundred slabs of *fine* quality have fetched 113s. with full prompt.

Copper Ores.

Sampled July 9, and sold at the Royal Hotel, Truro, July 24.

Mines	Tons.	Purchasers.	Price.		
West Caradon	75	8	5	0	6
	74	8	4	12	0
	73	2, 6	8	14	6
	64	7	4	17	0
	56	9	7	8	0
	55	5	10	8	0
	47	1	11	11	6
	43	2	7	12	6
	42	7	4	12	0
South Caradon	96	3	9	8	6
	95	1	9	9	6
	74	6	5	11	0
	50	1, 5	16	11	0
	47	1, 5	16	11	0
	46	3	5	7	0
	45	5	2	0	6
	30	1	5	14	6
North Treskerby	95	9	4	4	0
	93	8	5	4	0
	77	6	5	15	0
	76	7	5	1	6
	58	7	3	10	0
	57	8	3	11	0
	27	7	15	0	0
Great Wheal Busy ...	78	10	2	6	6
	70	8	2	16	6
	66	7, 10	2	15	0
	61	7	3	8	0
	56	7, 10	1	17	0
Great Wheal Busy ...	41	6	3	6	6
	28	6	6	11	6
Clifford Amalgamated	106	1, 3, 6, 8	3	9	6
(United Mines)	48	5	3	10	0
	43	5	3	1	0
	40	12	2	15	0
	24	12	2	19	6
	20	10	2	11	6
North Downs...........	53	4, 6	6	13	6
	52	6	4	15	0
	47	2	7	2	0
	41	6	7	7	0
Wheal Polmear	51	1	4	7	6
	45	2	3	19	0
	14	2	7	16	0
St. Day United.........	40	12	2	4	6
	34	3	4	17	6
	26	10	1	15	6
South Crinnis	58	8	4	6	6
	42	8	5	3	0
Craddock Moor.........	67	1, 6	7	1	6
	30	5	7	1	0
Duchy and Peru	65	1, 5	0	9	0
	22	1, 5	0	15	6
New Treleigh	48	7	3	17	9
Burra Burra	21	10	2	9	0
	10	10	2	2	0
Perran Mines	24	5	4	0	0
Wheal Rose...........	24	3	5	4	0

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.		
West Caradon	529	£3,716	2	0
South Caradon	483	4,329	19	0
North Treskerby	483	2,521	8	0
Great Wheal Busy............	400	1,192	0	6
Clifford Amalgamated	281	854	12	0
North Downs	193	1,235	16	6
Wheal Polmear	110	510	1	6
St. Day United	100	300	18	0
South Crinnis	100	£467	3	0
Craddock Moor	97	685	10	6
Duchy and Peru...............	87	46	0	0
New Treleigh	48	186	0	0
Burra Burra	31	72	9	0
Perran Mines	24	96	0	0
Wheal Rose.....................	24	124	16	0

EACH COMPANY'S PURCHASE.

		Tons.	Amount.		
1	Vivian and Sons............	375	£2,993	19	0
2	Freeman and Co.	185½	1,266	19	9
3	Grenfell and Sons	226½	1,533	10	9
4	Crown Copper Co..........	26½	176	17	9
5	Sims, Willyams & Co. ...	337	2,048	16	0
6	Williams, Foster & Co....	436	2,546	13	6
7	Mason and Elkington ...	437	2,033	5	0
8	Bankart and Sons	495½	2,160	4	3
9	Copper Miners' Co.	151	£813	8	0
10	Charles Lambert	216	494	0	0
11	Newton, Keates & Co ...	—	——		
12	Sweetland and Co.	104	271	8	0
13	Neath Copper Co..........	—	——		
	Total	2990	£16,339	2	0

Average Produce, 7.
Quantity of Fine Copper, 209 tons 6 cwt.

Average Standard £117 7 0
Average Price per ton............ £5 9 6

Copper Ores.

Sampled July 16, and sold at Tyack's Hotel, Camborne, July 31.

Mines.	Tons.	Purchasers.	Price.		
Clifford Amalgamated	114	7, 9	£3	18	0
(Wheal Clifford)	107	1, 7	5	15	0
	103	9	5	15	0
	102	13	6	2	6
	94	6	5	12	6
	89	13	4	18	6
	79	13	7	0	6
	57	7	4	15	0
	39	9	5	1	0
	36	7, 13	4	1	0
	26	7	4	14	0
(Consols)	49	9	5	13	0
	41	6	6	8	6
West Seton	73	1, 6	8	14	6
	66	2	5	6	0
	65	3	7	4	0
	63	8	5	2	0
	62	3	6	15	0
	60	7	2	8	6
	58	3	5	16	6
	57	6	6	13	0
	45	3	5	16	6
	40	3, 4, 6	6	12	6
Wh. Seton (Pendarves)	130	10	1	1	6
	65	4, 6	5	5	0
	61	7	4	0	0
	48	4, 6	7	3	0
	47	7, 9	4	14	0
	35	3	14	0	6
East Pool	76	2	4	17	6
	65	13	5	8	0
	60	1, 5	0	5	0
	46	10	3	7	6
	42	10	3	12	0
	37	10	2	13	0
Fowey Consols	69	5	5	16	6
	65	9	4	19	0
	64	1, 5	5	18	6
	62	1	6	4	6
	60	7	5	17	0
Tincroft	70	3	3	16	0
	60	6	4	4	6
	52	6	5	2	6
	51	3	2	4	0
	50	1	2	5	6
	18	1	1	10	0
East Crinnis & S. Par	78	5	6	3	0
	60	1, 8	6	1	6

Mines.	Tons.	Purchasers.	Price.		
East Crinnis & S. Par	64	1	£6	1	6
	50	8	3	4	6
Condurrow	60	13	4	9	6
	45	2, 7, 9	4	11	6
	41	5	2	1	6
	32	12	1	11	6
	23	5, 7	9	10	0
	8	13	9	13	6
South Frances	56	1	5	18	6
	50	6	6	16	6
	41	1, 6	7	17	6
	40	2	4	4	6
	13	5	14	0	6
	6	12	3	15	6
Wheal Grenville	47	5	3	18	0
	39	7, 9	4	7	0
	34	9	4	11	0
	33	5	9	19	0
	28	5	4	16	0
	25	5	5	2	6
Wheal Basset	68	1	6	8	6
	67	1	5	4	6
	32	7	7	18	6
	29	7	8	9	0
	1	8	40	5	0
South Tolgus	68	13	3	3	6
	56	3, 4, 6	5	15	0
	50	2	6	0	6
East Basset	67	1, 3, 5	6	2	0
	39	1, 3, 5	6	2	0
	28	8	5	6	0
Tywarnhaile	74	8	2	9	0
	50	3	5	4	0
Camborne Vean	39	4, 6	5	8	0
	34	7	2	19	6
South Basset	37	7, 9, 12	1	11	6
	28	7, 9	1	2	6
Dolcoath	39	3	3	4	6
	25	6	6	17	0
Stray Park	53	13	3	17	0
Carn Camborne	16	8	14	10	6
	8	1	11	12	0
East Grenville	18	1	2	16	6
South Crofty	8	2	1	13	0
	5	3	4	11	6
Emily Henrietta	8	2	6	12	0
Wheal Trefusis	3	12	1	19	6

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.		
Clifford Amalgamated	936	£5,074	17	6
West Seton	589	3,584	1	0
Wheal Seton	386	1,779	19	6
East Pool	326	1,141	0	0
Fowey Consols	320	1,807	16	6
Tincroft	301	1,038	19	0
East Crinnis and S. Par.	242	1,333	10	0
Condurrow	209	744	15	0
South Frances	206	1,369	15	0
Wheal Grenville	206	1,100	8	0
Wheal Basset	197	1,325	2	0
South Tolgus	174	837	12	0
East Basset	134	£795	0	0
Tywarnhaile	124	441	6	0
Camborne Vean	73	312	14	6
South Basset	65	89	15	6
Dolcoath	64	296	1	0
Stray Park	53	205	7	6
Carn Camborne	24	165	0	0
East Grenville	18	50	8	0
South Crofty	13	36	3	0
Emily Henrietta	8	53	0	0
Wheal Trefusis	3	5	17	0

EACH COMPANY'S PURCHASE.

		Tons.	Amount.		
1	Vivian and Sons	604 5-6	£3,264	17	8
2	Freeman and Co.	263	1,324	6	6
3	Grenfell and Sons	547½	3,174	15	4
4	Crown Copper Co.	108	644	2	11
5	Sims, Willyams & Co.	476 5-6	2,568	18	2
6	Williams, Foster & Co.	544	3,327	15	5
7	Mason and Elkington	583¾	2,663	2	0
8	Bankart and Sons	262	1,106	15	6
9	Copper Miners' Co.	431½	2,063	17	6
10	Charles Lambert	255	544	5	0
11	Newton, Keats & Co.	—	—		
12	Sweetland and Co.	53½	98	3	6
13	Neath Copper Co.	542	2,807	8	6
	Total	4671	£23,588	8	0

Average Produce, 6¾.
Quantity of Fine Copper, 302 tons 4 cwts.

Average Standard £120 11 0
Average price per ton 5 1 0

Copper Ores.

Sampled July 23, and sold at Tabb's Hotel, Redruth, Aug. 7.

Mines.	Tons.	Purchasers.	Price.	Mines.	Tons.	Purchasers.	Price.
West Basset	75	3	£4 5 6	Great South Tolgus	35	13	£5 17 6
	73	3	4 10 0		33	2, 5	10 0 6
	66	3	5 6 6		21	13	9 3 0
	59	3	4 13 0	Wheal Anna	52	13	6 11 6
	39	8	9 14 6		25	1	1 14 0
	34	5, 7	5 9 0		18	1, 7	3 10 6
	33	3	5 9 0	Copper Hill	63	1	1 12 6
	31	3	4 11 6		30	1, 5, 9	7 7 6
Carn Brea	132	1, 5	0 1 0	Treloweth	49	7, 9	4 4 0
	64	4, 6, 7	3 4 6		20	7, 9	6 19 0
	53	4, 6	5 11 6		13	9	13 13 0
	50	7	3 19 0	Charlotte United	32	1	6 2 6
	48	2, 3	6 3 0		25	1	7 15 6
	47	7	3 2 6		24	1	3 16 6
Par Consols	78	6	9 19 6	Rosewarne Consols	40	7	9 16 6
	70	5, 6	7 13 6		35	5	7 19 6
	68	10	1 18 6	Rosewarne United	28	8	4 10 0
	65	6	7 7 6		24	6	9 14 6
	27	8	4 1 0		15	2	9 15 6
Levant	87	8	1 16 6	Great Wheal Alfred	36	1, 7, 9	2 10 6
	70	1, 6, 8, 9	5 0 6		18	7	2 5 0
	40	9	5 12 0	Wheal Buller	32	2	3 18 0
	37	9	7 1 6		14	2	14 1 0
	2	8	13 12 6	Wheal Unity Consols	15	13	4 2 6
Pendeen Consols	76	1	3 11 6	Boscaswell	15	8	7 17 0
	60	8	3 17 0	Stevens's Ore	15	7	1 14 0
	53	1	3 10 0	West Providence	10	13	5 2 0
	10	5	20 12 6	Camborne Consols	9	7	7 16 0
East Alfred Consols	68	1, 5	2 17 6	Great Crinnis	8	1	2 12 0
	56	1, 5	3 9 6	South Dolcoath	6	1	9 5 6
	26	1, 5	5 9 6	Higgin's Ore	5	1	2 14 6
Great South Tolgus	43	7	8 5 6	Molland Mine	52	13	5 10 6

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.		Tons.	Amount.
West Basset	410	£2,161 3 6	Rosewarne United	67	£506 0 6
Carn Brea	394	1,148 1 0	Great Wheal Alfred	54	131 8 0
Par Consols	303	2,034 13 6	Wheal Buller	46	321 10 0
Levant	236	1,023 11 0	Molland	52	287 6 0
Pendeen Consols	199	894 9 0	Wheal Unity	15	61 17 6
East Alfred Consols	150	532 9 0	Boscaswell Downs	15	117 15 0
Great South Tolgus	132	1,084 8 6	Stevens's Ore	15	25 10 0
Wheal Anna	95	447 17 0	West Providence	10	51 0 0
Copper Hill	93	323 12 6	Camborne Consols	9	70 4 0
Treloweth	82	522 5 0	Great Crinnis	8	20 16 0
Charlotte United	81	482 3 6	South Dolcoath	6	55 13 0
Rosewarne Consols	75	672 2 6	Higgins's Ore	5	13 12 6

EACH COMPANY'S PURCHASE.

	Tons.	Amount.		Tons.	Amount.
1 Vivian and Sons	506½	£1,667 11 3	9 Copper Miners' Co.	164	1,270 12 3
2 Freeman and Co.	101½	781 2 9	10 Charles Lambert	68	130 13 0
3 Grenfell and Sons	400	2,123 9 6	11 Newton, Keates & Co.	—	——
4 Crown Copper Co.	47 5-6	216 10 9	12 Sweetland and Co.	—	——
5 Sims, Willyams & Co.	264½	1,355 6 9	13 Neath Copper Co.	185	1,139 17 0
6 Williams, Foster & Co.	267½	2,063 18 6	Total	2557	£12,969 13 6
7 Mason and Elkington	315 5-6	1,625 5 6			
8 Bankart and Sons	263½	858 1 3			

Average Produce, 6½.
Quantity of Fine Copper, 165 tons 9 cwt.

Average Standard £121 0 0
Average Price per ton 5 1 6

No Sale on August 14th.

Copper Ores.

Sampled August 6, and sold at the Royal Hotel, Truro, August 21.

Mines.	Tons.	Purchasers.	Price.		
Devon Great Consols	121	1, 6	£8	6	0
	120	2	4	2	6
	115	6	3	5	6
	110	1, 6	4	8	6
	105	1	3	6	6
	104	1	1	7	6
	103	6	4	7	0
	101	7	3	19	6
	92	3	8	11	6
	91	2	4	0	6
	88	3, 9, 11	8	14	0
	86	13	5	9	6
	84	5, 9	4	4	6
	80	12	2	0	6
	74	9, 13	4	12	6
	70	9, 11	4	4	6
	69	11	4	3	6
	67	10	1	8	6
	66	3	10	0	0
	54	9	4	11	0
	53	7	3	0	0
	45	9, 13	4	12	6
	42	3	11	19	0
	20	13	5	2	6
East Caradon	99	1	5	14	6
	95	1	4	11	6
	91	9	5	6	0
	84	1	8	15	6
	83	1, 6	9	0	6
Marke Valley	108	6	5	1	6
	101	6	4	9	6
	82	6	5	7	6
	76	6, 7	2	19	6
	51	7	2	10	0
Phœnix Mines	83	5	4	15	0
	75	8	3	16	6
	67	5	5	5	0
Phœnix Mines	64	1	£2	18	6
	61	5, 7	4	5	0
	55	2	8	11	0
Wheal Crelake	87	10	2	13	0
	82	10	3	18	6
	77	7, 10	5	3	6
	72	10	2	5	0
	68	13	4	17	6
Devon and Cornwall	102	12	2	5	0
	99	9	2	12	6
	44	3, 9	10	1	0
Bedford United	115	8	4	15	6
	96	9	4	9	0
Wheal Edward	52	2	3	2	0
	51	9, 11	3	11	6
	29	10	1	18	0
	25	10	2	12	0
North Wheal Robert	65	12	1	17	6
	43	9	10	3	0
	42	9	4	1	0
Wheal Friendship	61	6	8	10	6
	53	7	7	17	0
	30	7	10	0	0
Wheal Emma	58	8	6	6	0
	41	9	3	15	0
	38	1	1	8	6
Wheal Arthur	81	5, 7, 10	1	17	0
	30	7	4	0	0
Sortridge Consols	62	13	9	2	6
	32	5	4	8	0
Brookwood	55	8	5	1	6
	2	1	15	10	6
Hawkmoor	29	7, 13	4	8	6
Fursdon	28	13	6	0	6
Palmountain's Ore	20	5	1	13	0
Wheal Gill	3	5	3	7	6

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.		
Devon Great Con	1960	£9,511	12	6
East Caradon	452	2,969	17	6
Marke Valley	418	1,794	8	6
Phœnix Mines	405	1,949	11	6
Wheal Crelake	386	1,440	0	6
Devon and Cornwall	245	931	11	6
Bedford United	211	976	6	6
Wheal Edward	157	463	12	6
North Robert	150	728	8	6
Wheal Friendship	144	£1,236	1	6
Wheal Emma	137	574	15	0
Wheal Arthur	111	269	17	0
Sortridge Consols	94	706	11	0
Brookwood	57	310	3	6
Hawkmoor	29	128	6	6
Fursdon	28	168	14	0
Palmountain's Ore	20	33	0	0
Wheal Gill	3	10	2	6

EACH COMPANY'S PURCHASE.

		Tons.	Amount.		
1	Vivian and Sons	748	£3,623	1	9
2	Freeman and Co.	318	1,492	14	6
3	Grenfell and Sons	251½	2,427	2	0
4	Crown Copper Co.	—	—		
5	Sims, Willyams & Co.	304½	1,286	19	0
6	Williams, Foster & Co.	765	4,018	12	9
7	Mason and Elkington	466½	2,080	1	0
8	Bankart and Sons	303	1,481	10	6
9	Copper Miners' Co.	679½	£3,343	7	0
10	Charles Lambert	427½	1,174	16	3
11	Newton, Keates & Co.	158 5-6	782	6	3
12	Sweetland and Co.	247	513	7	6
13	Neath Copper Co.	333	1,978	13	0
	Total	5007	£24,203	0	6

Average Produce, 6½.
Quantity of Fine Copper, 306 tons 11 cwt.

Average standard £123 17 0
Average Price per ton 4 16 6

Copper Ores.

Sampled July 23, and sold at Swansea, August 12.

Mines.	Tons.	Produce.	Purchasers.	Price.
Berehaven	92	9⅝	3	£7 17 0
	70	9¾	5	7 16 6
	100	9½	7	8 0 0
	49	9¾	3	8 0 0
	121	9⅝	6	7 18 0
	117	9⅞	2	8 3 0
	108	9⅝	2, 5, 7	7 15 6
	105	9¾	1, 5	7 18 0
Virgin Gorda ...	93	11⅝	8	9 14 0
	76	11⅞	1	9 16 6
Virgin Gorda ...	1	24	1	£19 19 0
Cobre	103	13	1, 8	10 10 6
Worthing.........	41	54½	11	47 17 6
Mount Rose......	20	30⅝	12	26 12 6
	15	23⅝	15	20 6 0
	3	48½	5	41 6 0
Almeria	37	6	3	4 14 0
British Reg.......	8	37½	11	33 5 6
Holyford	4	13½	15	11 10 0
London............	1	21⅝	5	17 10 0

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.
Berehaven	762	£6,040 12 0
Virgin Gorda..........................	170	1,668 15 0
Cobre	103	1,084 1 6
Worthing	41	1,962 17 6
Mount Rose	39	960 18 0
Almeria	37	£173 18 0
British Regulus	8	266 4 0
Holyford..............................	4	44 0 0
London	1	17 10 0

EACH COMPANY'S PURCHASE.

	Tons.	Amount.
1 Copper Miners' Co.	181	£1,723 8 9
2 Freeman and Co.............	153	1,233 9 0
3 Grenfell and Sons	178	1,288 2 0
4 Crown Copper Co.	—	——
5 Sims, Willyams & Co........	162½	1,383 16 0
6 Vivian and Sons	121	955 18 0
7 Williams, Foster & Co. ...	136	1,079 18 0
8 Neath Copper Co.	144½	1,444 2 9
9 British and For. Copper Co.	—	——
10 Mason and Elkington ...	—	——
11 Bankart and Sons	49	2,229 1 6
12 Charles Lambert	20	532 10 0
13 Ravenhead Copper Co....	—	——
14 Sweetland, Tuttle & Co.	—	——
15 Jennings and Co.	19	348 10 0
Total	1164	£12,218 16 0

Sampled August 6, and sold at Swansea August 26.

Mines.	Tons.	Produce.	Purchasers.	Price.
Cuba...............	95	11½	5	£9 2 6
	87	11¼	5	9 1 6
	83	11⅝	3	9 5 0
	82	11½	3	9 5 0
	78	11½	15	9 7 6
(Precip. S.I.M.)..	6	57	5	46 10 6
	55	19½	9	16 5 6
	50	19⅝	3	16 8 0
	42	19½	3	16 12 0
(Precip. S.I.M.)..	5	57⅝	6	46 15 0
	67	12⅝	7	10 1 0
	28	12¾	5, 7	10 0 6
Cobre	92	14⅝	7, 15	11 12 6
	89	14⅝	7	11 12 6
	88	14	1	11 10 0
	67	14	3	11 16 0
	66	13⅞	6	11 12 0
	14	68⅞	5	57 3 6
	13	65⅞	6	56 2 0
Cobre	12	67½	6	£56 2 0
	11	68¼	6	58 6 0
	6	14⅝	15	11 4 6
Knockmahon ...	98	11⅝	7, 9	10 1 0
	88	11¼	1, 9	9 7 6
	33	12⅝	2	10 12 0
	96	5	6	3 15 0
Berehaven	100	10¼	9	8 18 6
	63	10½	2, 3	8 12 0
	86	12	2, 7	10 4 0
Laxey	83	6¼	3	5 7 6
	15	4¾	3	3 15 0
Del Soto	49	20½	7	17 1 0
	46	19½	7	16 17 0
	1	18	7	14 14 0
Seville	50	20⅝	2	16 17 0
	1	20⅝	1	17 0 0
Lochwinnoch ...	25	7	2	5 14 0
Karrington	4	—	2	19 14 0

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.
Cuba	678	£7,793 3 6
Cobre..............................	458	7,583 18 6
Knockmahon	315	2,619 14 0
Berehaven	249	2,311 10 0
Laxey	98	502 7 6
Del Soto	96	£1,625 5 0
Seville	51	859 10 0
Lochwinnoch	25	142 10 0
Karrington	4	78 16 0

EACH COMPANY'S PURCHASE.

	Tons.	Amount.
1 Copper Miners' Co.	133	£1,441 10 0
2 Freeman and Co...............	186½	2,123 2 0
3 Grenfell and Sons	453½	4,507 6 6
4 Crown Copper Co.	—	——
5 Sims, Willyams & Co.	216	2,876 7 0
6 Vivian and Sons...............	203	3,403 3 0
7 Williams, Foster & Co.......	404	5,039 7 6
8 British and For. Copper Co.	—	——
9 Mason and Elkington	248	2,692 11 6
10 Bankart and Sons	—	——
11 Charles Lambert	—	——
12 Ravenhead Copper Co. ...	—	——
13 Sweetland, Tuttle & Co.	—	——
14 Jennings and Co............	—	——
15 Neath Copper Co.	130	1,333 7 0
Total.....................	1974	£23,416 14 6

Black Tin Sales.

Date.	Mines.	Tons. c. q. lbs.	Price per ton £ s. d.	Purchasers.	Amount of Money. £ s. d.
July 17.	Gt. Wh. Vor	22 10 0 8 ...	— ...	———	1516 16 9
„ 18.	Trevenen, &c.	6 5 3 23 ...	68 10 0 ...	Enthoven & Sons.........	431 8 0
	„	1 2 0 27 ...	42 0 0 ..	ditto	46 14 1
„ 19.	West Wh. Jane.........	12 9 3 10 ...	62 10 0 ...	Calenick	780 14 11
	So. Carn Brea	5 6 2 16 ...	61 15 0 ...	Bissoe	329 5 2
	„	6 0 1 24 ...	61 15 0 ...	Trethellan..................	371 18 7
„ 25.	Cuddra	5 8 1 4 ...	66 0 0 ...	———	357 6 10
	„	0 2 0 13 ...	52 0 0 ...	———	5 10 0
„ 26.	Par Consols	22 8 0 12 ...	63 5 0 ...	———	1417 2 7
	„	4 14 0 17 ...	42 0 0 ...	———	197 14 4
	W. Fowey Cons.........	47 19 3 2 ...	63 5 0 ...	———	3035 5 2
	Wheal Kitty	9 11 1 10 ...	— ...	———	578 6 2
	Penhalls	5 13 2 14 ...	— ...	———	359 15 0
	St. Day United	32 6 2 8 ...	— ...	Harvey & Co.	1757 19 1
	Drake Walls	6 10 0 0 ...	69 0 0 ...	R. R. Michell	448 10 0
	„	13 10 0 0 ...	67 2 6 ...	Harvey & Bissoe	922 19 4
	Furze Hill Wood	3 12 0 0 ...	66 5 0 ...	R. R. Michell	238 10 0
„ 29.	Gt. Wh. Busy	12 14 3 25 ...	— ...	Bissoe Co.	722 18 9
„ 31.	St. Just United.........	1 10 3 1 ...	65 0 0 ...	Bolitho & Sons	99 19 0
	„	1 6 3 20 ...	62 10 0 ...	ditto	84 3 0
	„	1 4 2 21 ...	65 5 4 ...	Daubuz & Co.	80 10 10
	„	1 0 2 22 ...	63 15 0 ...	ditto	65 19 4
	„	1 4 3 1 ...	61 15 0 ...	ditto	76 8 10
Aug. 5.	Gurlyn	4 10 2 10 ...	62 10 0 ...	Chyandour	283 1 6
„ 15.	Gt. Wh. Fortune	18 19 1 2 ...	——— ...	———	1313 4 4
	Wheal Vyvyan.........	0 18 2 19 ...	62 10 0 ...	Charlestown...............	68 17 9
	„	0 5 0 2 ...	42 0 0 ...	ditto	
	Trevenen	5 16 0 10 ...	68 10 0 ...	ditto	459 1 0
	„	1 9 1 1 ...	42 0 0 ...	ditto	
„ 16.	Gt. Wh. Vor Utd......	21 15 1 15 ..	——— ...	———	1462 18 6
	Leeds & St. Aubyn ...	4 8 0 8 ...	62 0 0 ...	———	273 0 6
	Bottle Hill	2 19 1 20 ...	63 2 6 ...	———	322 9 9
	„	0 2 3 8 ...	38 0 0 ...	———	
	„	1 19 0 25 ...	63 15 0 ...	———	
	„	0 2 1 2 ...	40 0 0 ...	———	

Sundry Copper Ore Sales.

AT LIVERPOOL, by Mr. J. PITCAIRN CAMPBELL.

Date.	Mines.	Lot	Tons.	Price per ton. £ s. d.	Purchasers.	Amount of Money. £ s. d.
July 17.	ex Donald McKay,	Lot 1	77	... 11 3 0 ...	C. Lambert; Bibby ...	2779 6 0
		2	77	... 11 15 6 ...	Bibby, Sons, & Co. ...	
		3	76	... 11 6 6 ...	Copper Miners' Co. ...	
	ex Antonio Puppo	4	32¼	... 4 15 0 ...	J. Keys & Son	
„ 17.	Parys Mines	Lot 1	50	... 5 15 0 ...	Newton, Keates, & Co.	1107 17 6
		2	50	... 5 15 0 ...	Sims, Willyams, & Co.	
		3	75	... 4 2 6 ...	Grenfell & Sons.........	
		4	50	... 2 3 6 ...	C. Lambert..............	
		5	50	... 2 5 6 ...	ditto	

AT LIVERPOOL, BY MR. JAMES HALLOWS.

Date.	Mines.	Lot	Tons.	Price per ton. £ s. d.	Purchasers.	Amount of Money. £ s. d.
„ 31.		Lot 1	60	... 14 0 6 ...	C. Lambert...............	8351 18 0
		2	69	... 14 0 6 ...	St. Helen's Co.	
		3	77	... 17 0 6 ...	Bibby and Sons	
		4	77	... 16 12 6 ...	Newton, Keates, & Co.	
		5	77	... 16 16 0 ...	St. Helen's Co.	
		6	76	... 16 9 6 ...	Newton, Keates, & Co.	
		7	76	... 16 16 6 ...	Bibby & Sons	

AT LIVERPOOL, BY MR. JAMES KEYS.

Date.	Mines.	Lot	Tons.	Price per ton. £ s. d.	Purchasers.	Amount of Money. £ s. d.
Aug. 6.	ex Ardbeg.	Lot 1 (regulus)	69	... 2 3 0 ...	Sims, Willyams, & Co.	2369 10 0
		2 „	69	... 1 19 0 ...	ditto ...	
		3 „	69	... 1 19 0 ...	ditto ...	
		4 „	69	... 1 19 0 ...	ditto ...	
		5 „	69	... 1 17 0 ..	ditto ...	
		6 „	69	... 1 17 0 ...	ditto ...	
		7 (ore)	59	... 4 3 0 ...	C. Lambert...............	
		8 „	59	... 4 3 0 ...	ditto	
		9 „	56	... 8 5 0 ...	Copper Miners' Co. ...	
		10 „	56	... 8 5 0 ...	ditto ...	
		11 „	18	... 1 5 0 ...	ditto ...	
„ 21.	Parys Mines	Lot 1 (cp. ore)	100	... 5 15 6 ...	St. Helen's Co.	2779 9 0
		2 „	75	... 5 17 6 ...	ditto	
		3 „	100	... 5 15 6 ...	Mona Co..................	
		4 „	75	... 5 17 6 ...	ditto	
		5 (precip.)	20	... 11 17 0 ...	ditto	
		6 „	12	... 3 3 6 ...	ditto	
		7 „	10	... 9 9 0 ...	ditto	
		8 „	20	... 11 17 0 ...	Newton, Keates, & Co.	
		9 „	12	... 3 3 6 ...	ditto ...	
		10 „	10	... 9 9 0 ...	ditto ...	

Lead Ore Sales.

Dates.		Mines.	Tons.	Price per Ton. £	s.	d.	Purchasers.	Amount of Money. £	s.	d.
July	23.	Trelawny	80	26	2	0	Sims, Willyams & Co.	2543	0	0
		"	50	9	2	0	ditto			
"	24.	Westminster	35	11	16	6	Newton, Keates & Co.	413	17	6
		Maesysafn	100	12	19	0	Adam Eyton	1295	0	0
		Mount Pleasant	15	12	3	0	Walker, Parker & Co.	182	5	0
		Hendre Ucha	18	12	15	0	ditto	326	12	6
		"	7	13	7	6	Adam Eyton			
		Bryngwyn	9	13	0	0	Walker, Parker & Co.	117	0	0
		Pantybuarth	10	12	11	0	Newton, Keates & Co.	125	10	0
		Merllyn	3½	12	4	0	Walker, Parker & Co.	42	14	0
		Pool Park	9	13	0	6	Newton, Keates & Co.	190	5	6
		"	6	12	2	6	Walker, Parker & Co.			
		Isle of Man Mining Co. (lead ore)	100	14	12	6	ditto	3876	5	0
		" (silver ore)	100	22	14	0	Sims, Willyams & Co.			
		" (silver chats)	25	13	15	0	ditto			
"	28.	Dyliffe	75	13	3	0	Walker, Parker & Co.	1826	5	0
		"	64	13	2	6	Adam Eyton			
		Dyfngwyn	37	12	15	0	Walker, Parker & Co.	471	15	0
		Rhoswydol	8	12	2	0	Newton, Keates & Co.	96	16	0
		Caeconry	24½	13	10	0	ditto	330	15	0
		Llanerchyraur	13	14	1	0	ditto	182	13	0
		Goginan	30	16	18	6	Walker, Parker & Co.	632	19	0
		"	8	15	13	0	ditto			
"	29.	Minera	100	12	19	0	ditto	5995	16	0
		"	100	12	19	0	ditto			
		"	100	12	19	0	ditto			
		"	24	12	19	0	ditto			
		"	100	13	1	6	ditto			
		"	30	13	1	6	ditto			
		"	10	10	0	6	Newton, Keates & Co.			
		North Porthilly	2½	11	11	6	R. Michell and Son	26	0	7½
"	30.	Wheal Mary Ann	53	25	10	0	Walker, Parker & Co.	1644	13	0
		"	26	11	5	6	Treffry's Estate			
Aug.	1.	West Chiverton	60	17	1	6	Newton, Keates & Co.	1497	0	0
		"	50	9	9	0	Par Smelting Co.			
		Newtownards	60	12	15	6	Mining Co. of Ireland	766	10	0
		Mill Dam	46½	11	7	6	Fairburn and Ashton	531	15	7½
"	2.	Herodsfoot	82	28	7	6	Treffry Estate	2326	15	0
"	4.	Glogfach	60	15	11	0	Sims, Willyams & Co.	933	0	0
		East Logylas	70	12	3	0	Walker, Parker & Co.	850	10	
		Cwmystwith	100	12	7	6	ditto	1237	10	
"	7.	Dyliffe	60	13	1	6	Adam Eyton	784	10	0
		Llanrwst	30	12	0	0	Newton, Keates & Co.	360	0	0
"	8.	Cargoll	92	14	14	6	T. Somers	1354	14	0
"	11.	Clara United	18	12	1	0	Sims, Willyams & Co.	216	18	0
		Bronfloyd United	25	12	16	0	ditto	320	0	0
"	14.	Talargoch (Maesyrerwddu)	68	13	7	6	Newton, Keates & Co.	1922	18	0
		" (Coetia Llys)	72	14	1	6	Walker, Parker & Co.			
		Deep Level	8	12	1	6	Newton, Keates & Co.	96	12	0
		Rhosesmor	80	13	4	6	Walker, Parker & Co.	2131	5	0
		"	81	13	5	0	Adam Eyton			
		Orsedd	10	13	13	0	Newton, Keates & Co.	136	10	0
		Parry's	31	13	1	6	A. Courage and Co.	405	6	6
		Bryngwiog	37	13	1	0	Newton, Keates & Co.	482	17	0
		Long Rake	25	12	17	6	Adam Eyton	321	17	6
		Chware Las	3½	13	1	6	ditto	130	15	0
		"	3½	13	1	6	Newton, Neates & Co.			
		"	3½	13	1	6	Walker, Parker & Co.			
		North Henblas	4½	12	12	6	Newton, Keates & Co.	56	16	3
		Grosvenor	4	12	12	0	A. Courage and Co.	50	8	0
		Roman Gravels	35	12	14	6	Walker, Parker & Co.	445	7	6
		Llangynog United	22	12	11	0	Newton, Keates & Co.	276	2	0
		North Carrock	10½	12	5	6	ditto	209	13	6
		"	11½	7	0	6	ditto			
		Rhiwarth	3½	14	2	6	Walker, Parker & Co.	49	8	9
		Lower Park	7	12	8	6	A. Courage and Co.	86	19	6
"	14.	Llanfyrnach	16	13	2	6	Sims, Willyams & Co.	269	0	0
		"	8	7	7	6	ditto			
"	18.	Frongoch	170	12	4	0	Sims, Willyams & Co.	2074	0	0
		Glogfaur	23	12	10	0	Walker, Parker & Co.	287	10	0
		East Darren	75	14	17	0	ditto	1113	15	0
		Cwm Erfin	25	15	4	0	ditto	775	4	0
		"	26	15	4	0	Sims, Willyams & Co.			
"	21.	Wheal Ludcott	60	17	3	6	Newton, Keates & Co.	1510	10	0
		"	48	10	0	0	Walker, Parker & Co.			
"	18.	Wheal Ludcott (Silver ore)	84	—			—	3364	0	0

THE

MINING AND SMELTING MAGAZINE.

OCTOBER, 1862.

The Manufacture of Pig Iron in Scotland.

(Foundry Pig.)

By MM. Gruner and Lan.

(Abstracted from the *Annales des Mines*, 5th series, vol. xx, p. 183.)

General Considerations.

THE coal formation of the south of Scotland extends from the West Coast, W.S.W. of Glasgow, to the Eastern Coast, E. and N.E. of Edinburgh. It is divided into a certain number of basins, separated by barriers of crystalline, transition, and trappean rocks, each basin being generally characterised by particular beds of coal and iron ore as well as refractory clays and limestones. They generally derive their names from the counties in which they are situated; some of the principal being thus distinguished as the basins of Lanarkshire, of Ayrshire, of Renfrewshire (Paisley), of Stirlingshire, &c.*

In a metallurgical point of view Lanarkshire is by far the most important; for out of between 400 and 420 collieries worked in Scotland,—Lanarkshire contains from 160 to 170, Ayrshire from 90 to 100, Stirlingshire from 35 to 40, Fifeshire 40—the remainder being distributed among the other basins. According to Mr. Hunt, out of a total coal production of 8,926,249 tons in Scotland, in 1858, Lanarkshire yielded nearly one-half, that is, from 3 to 4 millions of tons. Again, while Ayrshire, which is next in importance to Lanarkshire, ships a considerable proportion of its produce, almost the whole of the coal raised in Lanarkshire is consumed in the locality. Mr. William Moore estimates the production of this basin to be 3½ millions of tons, of which about 2 millions are consumed in the making and manufacture of iron, the remainder being used for

* For a description of the Scottish coal-field, see Hull's "Coal-fields of Great Britain," 2nd Edit., p. 163.—Ed.

general manufacturing and domestic purposes in Glasgow and its neighbourhood.* The Boghead pits, in the eastern part of Lanarkshire, are about the only ones that can properly be said to export largely.

The proportionate importance of Lanarkshire in the make of iron is still more striking. Out of 174 blast furnaces in Scotland in December, 1859, 106 were situated in this county, against 41 in Ayrshire; the remaining being distributed through Stirlingshire, Fifeshire, &c. We may add, that of those out of Lanarkshire none, excepting the Glengarnock furnaces, furnished iron comparable in quality to the marks of the principal works of that county.

When MM. Dufrénoy, Elie de Beaumont, Coste, and Perdonnet visited Scotland for the last time, previous to the publication of the second edition of their *Voyage Métallurgique en Angleterre* (Paris 1837) little was known of Lanarkshire beyond the immediate environs of Glasgow. The coal basin had first been touched upon to the east of that town, round which were the only existing works; those of Clyde, Calder, Monkland, and Gartsherrie. The works then in operation showed two principal coal series: an upper one, supposed to contain seven beds of coal, and a lower one, which the authors of the *Voyage Métallurgique* particularly pointed out as being rich in iron ores. But nothing was said of the blackband—the ore specially characteristic of Scotland—although it was then known and even slightly worked in the upper series, and named the *Mushet Blackband*.

Since then, mining works have considerably extended along the valley of the Clyde, more particularly on the right bank of that river between Glasgow and Netherburn. It is in this central district that the upper series of the coal formation of Lanarkshire becomes so fully developed, with its numerous beds of coal and bands of ironstone, including the celebrated *Mushet Blackband*. It is to these rich deposits of the upper series that the well known works of Gartsherrie, Calder, Summerlee, Monkland, Dundyvan, &c., all erected on the plateau which rises above the Clyde on the north, owe their prosperity and reputation during the last thirty years. To the north and east of this Clyde basin the upper series progressively disappear as we advance towards Stirlingshire (Kilsyth, Possil, Denny) in the one direction, and towards Linlithgowshire (Edinburgh) in the other. In the two latter counties the lower series is almost alone met with—with its limestones, refractory clays, and iron ores, but with a much inferior development of coal compared with the upper series.

According to Mr. William Moore, the upper series has, in Lanarkshire, a total thickness of 300 or 400 yards, containing nine seams of coal, with a total thickness of from 37 to 38 feet, and six or seven bands of blackband iron ore, of a total thickness of from 5 to 5½ feet. The thickest seam of coal is the *Ell Coal*, 8 feet thick, and the most esteemed of the blackbands is the *Mushet Blackband*, 16 inches thick.

The lower series is 1,100 yards thick, and, in Lanarkshire, only

* Trans. Glasgow Philosophical Society, 1860.

contains three or four moderate seams of coal, of a total thickness of from 8 to 10 feet, and four bands of ironstone, with a total thickness of 3 or 4 feet. This series, however, improves a little northward in Stirlingshire.

Hence the total number of seams of coal amounts to twelve or thirteen, and the bands of ironstone to ten. But the number really workable is less than would appear from this. Thus, among the coal seams, the three called *Upper Coal*, *Humph Coal*, and *Sourmilk Coal*, appear not only to be unfit in quality for blast furnaces, but to be also unworkable in a great many parts of Lanarkshire on account of their thinness, and particularly in the environs of Airdrie and Coatbridge, those great centres of metallurgical industry. The other seams of the upper series, that is those called the—*Ell Coal*, *Pyotshaw* and *Main Coals*, *Splint Coal*, *Virtue-well* and *Kiltongue Coals*, and *Drumgray Coals*, furnished (although very unequally) the coals fit for the smelting of iron. The *Splint Coal*, the most reputed in this respect, is at present nearly exhausted; and the others vary frequently in quality and thickness in very narrow distances.

The lower series is not considered workable for coal in Lanarkshire; and if northwards, at Kilsyth, in Stirlingshire, its outcrop shows seams of good quality, these only yield very inferior coals, at Boness and Kinneil, although the seams continue tolerably thick; it is the same at Bathgate, in Linlithgowshire. At Possil, the workings of the lower measures have shown two beds of coal, as well as the *Possil Blackband;* but the seams are too thin for a regular workings.

The irregularities in thickness and quality are still greater in ironbands than in the coal seams. Out of the ten or twelve which are found in the basin, we can only calculate on half, seven at the most, as really workable. These bands are the following:—*Mushet*, *Rough*, *Bellside*, *Calderbrae*, *Slaty*, *Possil*, and *Govan*. Excepting the second of these bands, which is an argillaceous ore (clayband), all the others are blackbands or bituminous carbonates of iron.

Considering the frequent variations in thickness and quality of the seams of coal and ironstone, and taking also into account the numerous outbursts of trappean rocks with their connected disturbances—faults, nips, &c.—we can understand that the different basins still remain circumscribed in Scotland, particularly where the works are wholly disconnected. Hence the proprietors recoil from all explorations in depth. On the Monkland plateau, in particular, it has been sufficient that a few not very deep pits have missed the lower beds of coal or ironstone, to cause a hesitation at present as to sinking deeper the pits which have hitherto served for working the *Splint Coal*, *Mushet Blackband*, *&c*. Having but small confidence in the continuation of the beds, the proprietors prefer removing to Govan, to Possil, to Denny, to Kilsyth, to Bathgate—that is going away from the centre of their metallurgical operations—in order to reach more certainly, at shallow depths, the iron ores of the lower series. It is generally admitted, nevertheless, that the basins of Ayrshire, Fifeshire, Clackmannanshire correspond with the lower series of Lanarkshire.

Our knowledge of the coal fields of Scotland is scarcely yet sufficiently advanced to enable us to estimate their mineral resources.

We will confine ourselves to referring to the estimate of Mr. William Moore for the county of Lanarkshire.

He values the coal in existence at 428,815,500 tons, and the ironstone at 72,081,400 tons. Admitting a present consumption of 3¼ million tons of coal, and 1 million tons of ironstone, the basin of Lanarkshire has assured resources for the continual working of 100 blast furnaces for 70 or 72 years, and coal for more than a century, at the present rate of working. In this estimate it must be understood that Mr. Moore has only valued what is at present really discovered and known. Now, it is clear that Lanarkshire contains, in depth, a series of strata as yet unexplored, which affords chances of new discoveries—chances sufficient to compensate, in a great measure, for any reserves we may have to make with respect to such estimates as those of Mr. Moore.

Future Prospects.—The existence of coal and ironstone (it is unnecessary to add of refractory clays and limestone) being thus assured to Lanarkshire for such a lengthened period, it remains to consider whether the working and utilisation of these sources of wealth can be carried out under the same favourable conditions as have been hitherto enjoyed by the Scotch iron-works.

In the infancy of this industry, the furnaces, like the coal and ironstone pits, were originally established near the out-crop of the beds. Thus the most important group of furnaces—that of the Monkland district—is placed on a mass of trappean rocks, which, to the east of Airdrie, forms the base of the upturned beds of the coal formation; that is to say, the depth of the workings was then comparatively trifling.

In those early days the iron-masters and colliery lessees also readily obtained, from the proprietors of the soil, grants at very moderate rents and royalties—4*d*. or 5*d*. per ton for coal, and 6*d*. to 15*d*. per ton for ironstone; while, thanks to the thickness and richness of the *Mushet Blackband* (which, calcined, yields from 55 to 60 per cent.) they were in a position, for more than 25 years, to supply a large number of blast furnaces from a relatively restricted space, which at once produced coal, ironstone, limestone, and clay, all of good quality and returnable at very low rates.

These conditions have remained unaltered up to recent times, in the case of the greater number of works in Lanarkshire. There are even some which have still portions of the *Mushet-band* and *Splint Coal* unexhausted not very far from their furnaces, and for which the old leases and dues are not yet expired. But these form a small minority of the Scotch works, and even they must, before very long, share the common fate of all the others; that is to say, not being able to move their blast-furnaces, they must go and seek elsewhere, at a greater or less distance from their works, in the first place, ironstone, and later on, coal, at increasing rents and royalties.

In this report we may take the case of many of the most important establishments, which, having wrought out a thick bed of blackband of great regularity and excellent quality, to the depths of 110, 220, and 280 yards, in the neighbourhood of Coatbridge and Airdrie, where the blast-furnaces are concentrated, are at present obliged to *seek*, at a distance of 20 miles from the blast-furnaces, the ironstone

of Possil, Kilsyth, Denny, and Bathgate, of a quality more variable, and occurring in thinner beds. It is true that the works and pits are connected, in various directions, by numerous canals and railways, but the rates are very high in Scotland for these short distances.

As to the rents and royalties, they are much changed both in respect to coal and the ironstone. Here, as in Wales, the dues per ton of coal vary from 6*d.* to 9*d.* In the environs of Wishaw (where coal exclusively is worked) some dues are as high as 1*s.* per ton for large, and 2*d.* to 2½*d.* per ton for small coal. For ironstone, the increase in the royalty has been much more striking, which follows naturally: 1st, from the effects of the great profits realized, or said to have been realized, by the original lessees; and 2nd, from the competition which has gradually sprung up among the latter for leases from the landlords.

As a minimum we must take from 2*s.* to 2*s.* 6*d.* per ton as the average royalty payable at present: some works pay as much as 3*s.*, 4*s.*, and even 6*s.*, for beds more or less equivalent to the old *Mushet Blackband.* And even these high rates are aggravated by the common imposition of minimum rents, obliging a minimum of extraction, which forces the Scotch iron-master or iron-miner to keep his works continually going, whatever may be the state of trade. We shall show, further on, how these alterations in the conditions of the manufacture of iron—involving the necessity of the transport of the ores to the furnaces, as well as the great increase of dues—have affected that branch of Scotch enterprise. We may conclude here by shortly referring to the other modifications which have affected this industry.

Except a certain deterioration in quality, and a greater irregularity in the seams, or portions of old seams, from the working of which we have henceforth to look for the supplies of coal, it does not seem that the conditions of working are, in this respect, particularly altered. The small inclination of the beds, and their moderate thickness, coupled with the nature of the roof and floor, and the small quantities of water flowing into the workings, are favourable conditions, which, taken in connection with the texture of the coal, enable a large proportion of that mineral to be removed. Even where it is removed by stalls and pillars, there is rarely more than one quarter of the coal abandoned, and the timbering is always insignificant. The quantity broken by a working miner, per 10 hours, varies from 2 to 4½ tons—rarely reaching 5 tons—in a seam from 5 to 7 or 8 feet thick. So that a pit raising 100 tons per day, with a seam from 5 to 5½ feet thick—of which from 2½ to 3 feet is pure coal—would employ from 50 to 60 miners, and 20 to 25 rollers.

The ironstone continues and will continue to be worked pretty generally in a manner independent of the coal: certain beds only, like the *Splint Coal*, are, at certain points, accompanied by a thin seam of blackband or clay-band, which is broken at the same time as the coal.

The iron-ores are worked by the long-wall system, the waste being generally sufficient, to a great extent, to fill up with. By this means the whole of the ore is taken away, but the cost is still

considerable, particularly in the cases of blackbands of 4, 5, or 6 inches thick—the usual thickness except in the case of the *Mushet-band.*

The following are extreme cases of the varying conditions of working beds of ironstone:

1. A working in the centre of Lanarkshire on a portion of the *Mushet-band*, 15 inches thick, with a solid schistose roof, and a floor of from 1 to 2 feet of coal, which is not taken away, but which serves for a hulking. In 10 hours a miner breaks about 2 tons of raw ore.

2. A working on a bed 4 or 5 inches thick, with an argillaceous schist for roof and floor: hulking in the schist. A miner can break but $\frac{1}{2}$ to $\frac{3}{4}$ of a ton in 10 hours.

These examples suffice to show that the conditions of working ironstone will, for the future, be less favourable than for the past, as the greater number of the beds of ore, other than the *Mushet-band*, are of inferior thickness. The Possil and Govan ironstones approach it in thickness and quality, but they are certainly less regular, as well as being much further from the central region of Lanarkshire. As to the *Slaty-bands*, the are incomparably inferior to all the proceding in richness and quality.

Clays and limestones are either wrought in special workings, as at Glenboig and Garnkirk, or these substances are raised from the same pits as the coal and ironstone. The best refractory clays are those raised from the special works of Garnkirk.

The conditions of the supply of these substances to the furnaces do not seem to have changed recently, although they seem to be improved compared with 25 years ago, if we may judge by a comparison of the present prices with those given by MM. Dufrénoy, Elie de Beaumont, Coste and Perdonnet. This is probably due to the improvement and multiplication of the means of transport, and to the concentration of the extraction to the special mine of Garnkirk.

One of the most important elements in an industry like that under consideration is the rate of labour, particularly that of the miner. Thus, most of the statistics collected in the district carefully register the mean annual rate of the miner's wages. We shall give these particulars for 1848–1859 further on, by which it will be seen that variations in the rate of labour depend at once on the state of trade and conditions affecting the subsistence of the workman. It is only, however, under the influence of very bad harvests that the price of food has an important effect on the rate of labour, when the masters consent to make sacrifices to check emigration. A too rapid increase of production provokes the same results.

With these exceptions, the industrial organization of Scotland consists in an entire independence between masters and men: the former reduce wages when the price of pig-iron falls, and the latter, fully alive to the variations of stocks, are not slow to claim their share in an advance. Strikes are consequently rare, and never attain the proportions they do elsewhere. The iron-masters avoid them by meeting all reasonable demands of the workmen; so that, when the latter meet with a firm resistance, they usually return promptly to work.

Technical Division.

I. *Historical.*—The making of pig-iron for second fusion has always been the *spécialité* of the Scotch blast-furnaces, which have thus largely contributed to the progress of this branch of siderurgical industry.

From 1790 to 1828, the improvements principally tended to an increase in the size and the production of blast furnaces, an increase which was rendered possible by the introduction of more powerful blowing machines.

During 1828 and the years immediately following, the application of hot air to the making of iron was a great boon to the Scotch trade; for not only was it in itself an improvement of the greatest importance, but it was particularly beneficial to Scotland, allowing as it did the substitution of raw coal for coke in blast furnaces.

The advantages of the employment of hot air were already recognised in 1833, as is shown by the documents found in the *Voyage Métallurgique en Angleterre*, vol. i, 2nd edition; indeed we shall have occasion to show that certain economical results, which were incontestably due to modifications in the forms and dimensions of blast furnaces introduced about the same period, were likewise attributed to the adoption of hot air.

From 1836 to 1845, the employment of air heated to increasingly higher temperatures became general in Scotland, but no other modification in the making of pig-iron seems to have been adopted during that period.

From 1845 to 1850, and more recently from 1850 to 1859, under the influence of the evidently increasing demand for Scotch pig-iron, the iron masters of the district adopted the principle of another increase in the dimensions of their blast-furnaces, a principle which had been already applied in other parts of the United Kingdom. From this has resulted an increased production of iron per blast-furnace.

In this summary of the changes made in the methods of making pig-iron in Scotland, it will be seen there is no mention of any utilisation of the flames given off at the throat. The iron-works in this district have, in this respect, made only a few unavailing attempts. We shall show further on the causes which have prevented, up to this time, the adoption of an arrangement now generally applied, not only on the continent, but also in a considerable number of blast-furnaces in England and Wales.

II. *The Raw Materials and their Preparation.*—1. *Coal.* The coals of Scotland, and particularly those of Lanarkshire, belong generally to the dry long-flamed class. For the use of the blast-furnace, they select those varieties which are hardest, purest, and contain the least possible quantity of pyrites. The *Splint Coal* seam owes its reputation to its constantly possessing those three qualities. The coals of the *Pyotshaw* and *Kiltongue* seams also possess these characteristics, but in a minor degree. An analysis of a sample of *Splint Coal* as given by Truran, shows:—

Carbon	76·5
Hydrogen	5·
Oxygen	9·1
Sulphur	0·8
Nitrogen	1·2
Ashes	6·4

And an analysis of a sample of the same coal by M. Schwarz shows 1 per cent. of sulphur. We see, therefore, that these coals are far from being entirely free from sulphur, or even very clean; indeed we have often observed that coals charged in the blast-furnaces contained veins or faces of pyrites perfectly visible to the naked eye.

The Scotch coals give, on carbonisation in a close vessel, but 55 or 60 per cent. of a light and badly agglomerated coke. On a large scale, when formerly coked in piles in the open air there was rarely obtained more than 40 or 50 per cent. of an impure and friable coke. At present coking is abandoned, almost all the Scotch blast-furnaces being supplied by raw coal; a few only in Fifeshire still consume a mixture of coal and coke, the latter being obtained from the more or less binding coals of the lower series of the Coal-measures.

2. *Iron Ores.* The iron ore most commonly used in Scotland is a *blackband*, a compact, dull, earthy mineral, with frequently a schistose or ribboned structure, and a colour varying from dark grey to black. Some varieties contain absolutely nothing but carbonate of iron and carbonaceous or bituminous matters—silica, alumina, lime, and manganese entering into their composition but in fractions of a per cent. Several iron-works in the Monkland districts have worked almost exclusively with these exceptionally pure ores until very recently; but the majority of blackbands at present available are inferior in produce, and are besides frequently mixed with pyrites and phosphoric acid in sufficient quantities to injure the quality of their products. The wide variations in the produce of different specimens of raw blackbands are shown by the following analyses:—

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
Carbonate of iron	85·44	29·03	63·00	63·61	76·98
Peroxide of iron	0·23	—	—	—	—
Carbonate of manganese ..	—	—	3·60	3·50	3·00
Carbonate of lime	5·94	1·52	2·96	—	3·66
Carbonate of magnesia ..	3·71	3·59	0·50	—	tr.
Silica	1·40	24·76	7·85	6·72	5·00
Alumina	0·63	20·10	7·95	—	1·70
Sulphur	—	—	0·19	0·21	—
Bituminous matters	3·03	21·71	13·56	—	9·50
Phosphoric acid	—	—	tr.	tr.	—
Metallic iron	41·30	14·00	30·40	30·50	35·70

These ores are calcined before being passed into the furnace. The calcination takes place in the open air, in piles from 10 to 15 feet high, and from 40 to feet 50 feet long or wide. The ore in large lumps as it comes from the mine is collected in this pile, the

sides of which are kept together by the smalls, which are thrown lightly up so as to form a kind of cover to the sides of the pile, which is lighted at the bottom by the aid of small coal. The calcination proceeds for about a month, the necessary heat being supplied by the combustion of the coaly matter contained in the raw blackband.

In certain slightly silicious varieties of this ore an agglomeration takes place during the calcination. In general the calcined ores are found in their original form but spongy, yielding, however, but a very small proportion of smalls during the various manipulations they undergo before their introduction into the blast-furnace. The following analyses, Nos. 6, 7, and 8 represent the respective compositions of the calcined ores resulting from Nos. 3, 4, and 5 of the raw blackbands given above.

<table>
<tr><th></th><th>No. 6.</th><th>No. 7.</th><th>No. 8.</th></tr>
<tr><td>Peroxide of iron</td><td>71·95</td><td>66·20</td><td>89·75</td></tr>
<tr><td>Protoxide of iron</td><td>—</td><td>—</td><td>tr.</td></tr>
<tr><td>Red oxide of manganese</td><td>3·94</td><td>8·95</td><td>0·70</td></tr>
<tr><td>Alumina</td><td>—</td><td>—</td><td>1</td></tr>
<tr><td>Clay</td><td>14·66</td><td rowspan="2">16·35</td><td>—</td></tr>
<tr><td>Lime</td><td>4·68</td><td>2·24</td></tr>
<tr><td>Sulphuric acid</td><td>2·57</td><td>—</td><td>—</td></tr>
<tr><td>Sand</td><td>2·3</td><td>8·5</td><td>—</td></tr>
<tr><td>Sand and a little clay</td><td>—</td><td>—</td><td>5·</td></tr>
<tr><td>Phosphoric acid</td><td>—</td><td>—</td><td>0·95</td></tr>
<tr><td>Metallic iron (per cent.)</td><td>50·37</td><td>46·34</td><td>62·16</td></tr>
</table>

We are not aware whether M. Schwarz, to whom we owe the analyses Nos. 6 and 7, tried for phosphoric acid, but in the analysis No. 8, one of us took great pains in accurately determining this element, with the result shown. The analyses Nos. 1 and 2 made in England do not show phosphoric acid, but it is well to remember that the English chemists—practical men—rarely seek, in their assays or analyses, but for the principal elements, except when distinctly required by those forwarding the samples. It is probable, then, that phosphoric acid was never looked for in the samples Nos. 1 and 2. Such is the opinion of Mr. S. H. Blackwell, who, in quoting the analysis No. 1 adds:—"The phosphoric acid has not been determined here, but a sample of blackband from North Staffordshire, roasted and analysed by Dr. Percy, showed 1·69 per cent." In generalising on this failing of blackbands, Mr. Blackwell does not hesitate to attribute to it the great fluidity and small tenacity generally recognised as the characteristics of Scotch iron.

We may here remark on the subject of these ores, not only their high produce after calcination, but also the considerable percentage they contain of bases, particularly those of lime and oxide of manganese. Independently of the purifying action which these latter elements must have on the metal, it is easy to see that in sufficiently large charges they communicate a great natural fusibility to the ore, by which the proportion of lime may be much reduced, that is if the combustible is tolerably pure.

To sum up, the best varieties of calcined blackbands constitute a *rich*, *fusible*, and *easily reducible* ore—the more readily reducible in

proportion as it keeps its fragmentary state, yielding little smalls, and consequently avoiding falls or clogging up in the interior of the blast-furnaces. To show more clearly the great reductibility of these ores, it often accidentally happens in the calcining that certain fragments are found, consisting of a mixture of metallic iron and protoxide, as in the following analysis:—

Metallic iron	59·40
Protoxide of iron	25·80
Sulphide of iron	3·31
Clay, sand, and silica	10·48
Total	98·99

The argillaceous ores (claybands), worked more particularly in Ayrshire and in the counties of Fifeshire and Clackmannanshire, resemble more or less the ores of the same class found in the various districts of England; but they seem to be generally richer in Scotland. The following analyses will suffice to show the composition of the good varieties of these ores:—

	Raw Ore.		Calcined Ore.	
	No. 9.	No. 10.	No. 11.	No. 12.
Protoxide of iron and manganese ..	40·33	53·22	—	—
Peroxide of iron	1·87			
Peroxide of iron and oxide of manganese	—	—	78·82	75·95
Sulphide of iron	0·33	—	—	—
Lime	5·6	3·92	4·43	3·72
Magnesia	2·62	tr.	tr.	tr.
Alumina	4·76	2·66	3·7	3·33
Silica and clay	9·8	11·7	19·	17·
Water and carbonic acid..	32·29	28·5	—	—
Carbonaceous matters	2·4			
	100·	100·	100·	100·
Metallic iron (per cent.)	32·8	41·2	50·48	52·66

There is still another class of ore consumed, although as yet in small quantities: that is, the hæmatite or *red ore* of Cumberland, to which it is not necessary to make any special reference.

3. *Fluxes.* — The only flux used in Scotland is limestone, either raised from the Coal-measures themselves, or a purer kind procured from Ireland. The first is of a bluish-gray colour, most frequently bituminous, and often mixed with a certain proportion of clay, which makes it but an indifferent flux. The second has a chalky appearance, and contains, according to M. Schwarz:—

Carbonate of lime	97·75
Sand	0·82
Water	0·41
Organic matters and loss	1·02
Total	100·00

4. *Refractory Clays.*—The best refractory clays of Lanarkshire seem to rival the best kinds in England. M. Schwarz has ascertained them to have the following composition:—

Silica	59·40
Alumina	28·95
Peroxide of iron	1·05
Carbonate of lime	traces
Water and organic matters	11·05
Total	100·45

III. *Forms, Dimensions, Construction and Cost of Blast Furnaces.*—Two principal models are at present adopted in Scotland for the form of blast furnaces, which are shown in Figs. 1, 2, and 3 (Plate III, Vol. I, *Mining and Smelting Magazine*). The form shown in Fig 1 is, however, that most in use at present, opinions being much divided as to the necessity of giving furnaces such great heights as 55 or 60 feet; while they are equally decided as to the propriety of the increase in horizontal dimensions successively introduced during the last twenty or twenty-five years.

In another portion of their memoir, MM. Gruner and Lan have discussed generally the forms and dimensions of blast furnaces, of which we purpose giving an abstract in a future number. It will suffice to say here, that in 1833 all the transverse dimensions, except those of the hearth and the crucible, had been already greatly enlarged, and that the changes made since that period have been principally in the enlargement of these parts. The more simple forms—suppressing the hearth and boshes properly so called—which were on trial from 1830 to 1835, have gradually been definitively adopted; a form which recalls the blast furnace used on the Continent in the treatment of spathic ores.

In the matter of construction, Figs. 1, 2, and 3 show that decidedly much lighter forms have been adopted in Scotland as well as in the English districts, wherever new furnaces have been erected or old ones rebuilt. It is interesting to remark how much the thickness of the walls of the body, and even of the boshes, has been reduced without injury to the solidity or working of these immense apparatus: the thickness of the body, for the greater part of its height, not exceeding 3 or 4 feet against 6 or 7 at the boshes and the throat. It will be at once seen what a margin this leaves for the enlargement of the body in many old massive furnaces without having to rebuild them entirely—a necessity which has often caused the postponement of alterations advantageous in themselves.

At the prices of refractory materials given further on the total cost of a large blast furnace amounts in Scotland to about 4,500*l.*, not including the blowing or hot air machines.

In the greater number of Scotch furnaces the throat is open. In 1850 and the following years attempts were made at some works to utilise the waste gases; but all that was done was to make a certain number of openings 3, 4, or 6 feet below the throat by which the gases were brought either directly under the hot air apparatus erected at the top of the furnace, or brought into boilers lower down:

in these quickly abandoned experiments the throat was never even closed.

IV. *Accessory Appliances for Blast Furnaces.*—In that portion of their memoir treating generally of blast furnaces and their accessory appliances (which has been already referred to), MM. Gruner and Lan discuss the details of blowing and hot air machines. In addition to the information there given, they also include in this portion of their memoir a short description of the hot air apparatus of the Gartsherrie works; this, however, we shall reserve until we abstract that portion of the memoir treating generally of blast furnaces and their appliances. The cost of the Gartsherrie apparatus —with simple twyers at 90*s*. per ton, and more complicated ones at 160*s*.—the walls being 1½ feet thick, and brick and clays costing the prices stated further on,—is given at about 500*l*.

V. *Working and Action of the Scotch Blast Furnaces producing Foundry Pig.—Nature of the Products.*—1. *Composition of the Charges.* The composition of the charges naturally varies in different works according to the nature of the coals and the ores treated: the differences are, however, never very considerable, as will be seen from the following table. The volume and weight of the charges were, of course, increased in proportion to the increase in the dimensions of the furnaces, as will be evident in comparing those of 1833 with those of the present day.

	a.	*b.*	*c.*	*d.*	*e* and *f*
	cwts.	cwts.	cwts.	cwts.	cwts.
Coal	7	10	14	8	6 to 7
Coke	..	..	7	..	..
Ores	6½	8	15	6 to 7	6½
Lime	1½	2¾	5	1¼ to 1½	1
Produce of the ore per cent...	55 to 60	45	55 to 50	55 to 60	45 to 50

The letters *a*, *b*, *c*, *d*, *e*, *f* refer to the blast furnaces of the forms and dimensions already referred to; *e* and *f* being those in use in 1833; *a*, *c*, and *d* being the ordinary form in use at present (Fig. 2); and *b* being the highest type (Fig. 1). Excluding *c*, which refers to the very exceptional case in Scotland at present of coal and coke being simultaneously employed, we see that the extreme weight of the charges are represented by the two columns *a* and *b*, which correspond to the two types at present adopted.

The proportion of lime, which it will be seen ranges from 15 to 30 per cent., does not vary merely with the richness of the ore, but also, indeed specially, with the cleanness or otherwise of the combustible. These calcined blackbands, of 55 or 60 per cent. produce, certainly do not require 33 per cent. of limestone, as in the charge *e*: they would themselves scarcely require from 15 to 20 per cent., as in the example *d*; and the excess is necessitated not for the purpose of forming with the ores a sufficiently basic slag, but in order to fuse

the argillaceous matters contained in the rather dirty coal and coke employed in the charge *c*.

2. *Working of the Furnace.*—Without entering into details we may just point out the following distinguishing features in the working of the Scotch furnaces :—

a. The very high temperature of the blast.
b. The great pressure of the blast, and enormous production of foundry-pig.
c. A very slow working notwithstanding; the descent of the charges occupying as much time in the large furnaces of the present day as in the smaller ones of former times.
d. An increased consumption of coal in the furnaces since 1833.

3. *Nature of the Products* (Pig iron and Slags).—1. *Pig iron.* The soft grey foundry pig irons, for second and third fusion, are classed in the Scotch works into four sorts, called—Nos. 1, 2, 3, and 4.

The two first only are fit for casting in second fusion and capable of supporting in this operation a considerable proportion of old mixtures. The two first numbers are sometimes sold mixed, sometimes separate. The third is found to be too "bright" for second fusion ; and when it is not consumed by the works themselves in first fusion, it is sold mixed with the two others under the name of *mixed numbers* ($\frac{3}{5}$ths of No. 1 and $\frac{2}{5}$ths of No. 3 for instance). No. 4, and *à fortiori* No 5 ("mottled") when produced accidentally are only fit for forge use, or for certain hard castings of first fusion.

The great difference in commercial value between these numbers causes a careful register of the relative proportions produced of each to be kept at the different works—grouped two and two—Nos. 1 and 2, Nos. 3 and 4. The following shows the produce, in this respect of one of the principal works in Lanarkshire :—

Years.	Quantities obtained.		Materials Consumed per Ton of Pig Iron.			
	Nos. 1 & 2.	Nos. 3 & 4.	Ore.	Limestone.	Coal.	Smalls, for Heating.
	Per cent.	Per cent.	cwt.	cwt.	cwt.	cwt.
1842 to 1850	65·4	34·6	34·50	8·34	41·89	10·01
1850 to 1858	54·4	41·6	37·74	8·17	42·06	10·56

Notwithstanding the great regularity of the proportions of the materials consumed, it will be at once remarked that the returns of Nos. 1 and 2 have been less constant during the second than during the first period.

As to the composition of the pig iron we give the following analyses, the two first of which have been made by one of us—No. 15 on iron of the class No. 1, and No. 16 on that of class No. 4, coming from one of the most highly reputed for quality of the Scotch works. The analyses Nos. 17 and 18 (of iron of classes No. 1 and No. 2) are by Messrs. Penny and Wallace, chemists, of Glasgow, as are also Nos. 19 and 20—all four coming from the same works as the two first samples.

	No. 15.	No. 16	No. 17.	No. 18.	No. 19.	No. 20.
Free Carbon	2·300	2·700	4·40	1·75	1·65	1·00
Combined ditto ..	0·700	0·400	tr.	0·84		
Silicium	2·880	1·300	2·68	2·37	8·00	13·00
Sulphur	0·068	0·068	0·08	0·07	0·05	0·03
Phosphorus	0·210	(*a*)	0·10	0·07	—	—
Manganese	(*a*)	—	—	—	—	—
Iron	In quantities to make up the difference in all the analyses.					

(*a*) Not ascertained quantitatively.

Samples Nos. 17 and 18 are from the same pig—the first from the centre, and the second from the exterior of one of the extremities.

Samples Nos. 19 and 20 are of iron made from highly siliceous ores. The purchasers having complained of its bad quality, the ironmaster, after having had the analyses given above, corrected the working of the furnace by an augmentation of the proportion of limestone and a reduction of the proportion of the poor ores.

2. *Slags*. The slags are generally stony, of a greyish-white colour; sometimes, but very rarely, showing a few greenish vitreous veins—and that only when the working of the furnace became cooled, or when the pig fell back to Class No. 4. They are extraordinarily basic, and cool rapidly; and that their composition is tolerably constant we may judge by the following analyses :—

	No. 21.	No. 22.	No. 23.	No. 24.	No. 25.
Silica	32·65	35·00	35·34	36·40	31·60
Alumina	23·00	19·70	20·47	26·00	20·00
Lime	31·00	29·90	38·72	28·68	36·72
Magnesia	tr.	tr.	—	3·52	5·20
Protoxide of iron	2·00	1·00	tr.	1·50	1·80
Protoxide of manganese ..	4·20	8·20	—	0·50	0·07
Sulphide of manganese ..	8·10	7·00	5·39	—	—
Sulphide of calcium	—	—	1·35	—	—
Sulphur..	—	—	—	2·78	3·15
	99·95	100·80	101·27	99·38	98·54

The remaining portion of the memoir devoted to Scotland, which treats generally of the technical and economical results of the manufacture of iron in that country, will be concluded in our next.

Mineral and Geological Sketch of the Minera Mining Field.

DENBIGHSHIRE, NORTH WALES.

By George Darlington.

The study of the mineral and geological relation of any district remarkable for its large production of metallic ores, is necessarily a subject of interest to the practical miner; but when, in addition to the ordinary range of phenomena attending such deposits, we find special complications and peculiar geological features, we have a set of conditions which, although they demand a careful study to master, are yet fraught with unusual instruction and interest, both to the practical man and the scientific geologist. Such a combination of circumstances is to be found at Minera.

The Minera mines have been celebrated, since the commencement of the 18th century, for their remarkable production of lead ores; and at this moment they stand first in the list of British lead mines, both for their large returns of ore and for the great profits they yield. The district about them is equally remarkable, for within a radius of 5 miles from the mines, we find every common British mineral of commercial value except tin ore, and representatives of every strata occurring between the lias and the Cambrian; a portion of the English series of stratified rocks of far greater interest and value, in an economic sense, than all that remain.

Disregarding the Roman workings of these lead deposits, and the subsequent workings which tradition alleges to have occurred at various periods antecedent to the year 1700, I shall just give a brief summary of the more recent operations. About the year 1710 the first regular and systematic mining operations seem to have been commenced at Minera, beginning in that portion of the present sett then known as the West End mines. Here the near proximity of the ore-bearing strata to the surface, and the out-cropping of the lower measures, appealed at once to the miner; and extensive workings resulted on several veins and split portions of the main lodes, as well as in the flats, which abound in those particular strata. The gradual extension of these operations eastward, following the dip of the measures, induced other parties to make a trial of the still more eastern ground; and for very many years the results were profitable to both companies. From 1720 to 1824 (when the different leases terminated) the fortunes of both setts were chequered, as they fell into various hands (among which may be named those of John Wilkinson the iron-master, and Messrs. Noble and Hunt); yet the workings seem always to have been attended with a full measure of success. About 1816, the West End mines finally stopped, not so much, however, from poverty as from the enormous influx of water, which frequently flooded the mines, and entirely prevented the carrying on of regular operations; and, in 1824, the suspension of the East End mines followed from the same

causes, the "bottoms" being still rich and productive. At this time there were no less than seven steam-pumping engines on the two mines, all of considerable size; yet the West End mines were but 60 fathoms deep, and the East End mines but 105 fathoms deep to their extreme bottoms.

In the year 1849, Messrs. John Taylor and Sons having succeeded in obtaining the various leases (no less than eleven) of the setts, which originally went to form both the East and West End mines, the whole were consolidated together and put to work under one company—the present Minera Mining Company—the sett being about 2 miles long, by ½ a mile wide at the extreme breadth. Inasmuch as the former proprietors had failed in their operations from the great influx of water which invariably followed even a heavy shower, it was decided to make a radical attack at this difficulty by means of a very long and deep adit level. This fully succeeded in attaining the object proposed; but, even before it was completed, some new and fine bunches of ore were discovered at different points above the adit level, and from that period to the present time a continually increasing success has gradually brought these mines to their present highly prosperous condition.

The Minera sett occupies the larger portion of that small patch of Mountain Limestone, which, while forming the extreme southerly termination of the Flintshire mining field, has been disrupted from it by several faults, the chief of which is the great fault, known as the Denbighshire fault: certainly one of the most marked and powerful faults in Britain. The shift here is down on its northern side, with an easterly horizontal throw on its southern side. Within the boundaries of the sett we have also the Coal Measures and the Millstone Grit, as well as the underlying Silurian rocks.

The Mountain Limestone of the Minera district rests unconformably upon the Lower Silurian strata of Cyrn-y-Brain; but further south some thin sandstone and shales belonging to the Devonian series intervene between the Limestone and the Upper Silurian shales of the Llangollen hills. Upwards, the Limestone is usually overlaid by from 30 to 120 feet of Millstone Grit; in places, an excellent freestone, and this is again overlaid conformably by the true Coal measures. Occasionally the Millstone Grit is entirely absent, and the coal measures abut directly against the limestone. We have thus all the known formations existing between the Cambrian and the New Red Sandstone, in the space of about 5 miles; for if we draw the shortest straight line possible from the boundary of the Lower Silurian to the outcrop of the New Red Sandstone at Wrexham, we shall find that the distance does not much exceed this. These various strata—being frequently much disturbed—afford in this little field every kind of vein: the smooth "rake" vein, and the bunchy irregular one; the "pipe," "flat," and "feeder" veins; and the mere thin branches and strings of ore that often traverse a considerable length of "country," but are generally destitute of vein stone. These produce, as I have said, a very various assortment of the useful minerals, among which I may mention the Sulphides and Carbonates of lead, and that rare mineral the Aluminate of lead; the ores of zinc (Calamine and Blende); iron

ores, including clay ores, Blackband, and Hæmatite; with iron and copper-pyrites. Among the non-metallic useful minerals the district produces Coal, Slates, Freestone, Fire-clays, and Glass-sand.

There are two principal veins at Minera—the Old Vein and the Red Vein—both coursing almost the entire length of the property. The Old Vein is that from which the former proprietors obtained the greater portion of their returns; indeed, in the East End mines no other vein was, until recently, believed to exist. If we consider the various branches and splittings into which this vein separates as it goes west into the shallow measures, as forming an integral part of it, we must also consider the returns of the West End mines, to be derived in great part from the Old Vein.

This Vein is a really true fault, which has become variously filled with mineral matter. At Andrew's shaft, about the centre of the property, it has a down-throw of 410 feet to the north—the Millstone Grit and shales being to the one side of the vein and the limestone on the other. The throw of the fault varies, rapidly decreasing as it goes westward, while going eastward for some distance at least it seems to remain somewhat constant, attaining a maximum near Taylor's engine shaft. A remarkable exemplification of the character of this so-called vein occurs at this point, where, at the 220 yard level the Silurian rocks have been reached—these rocks forming the southern or up-throw side of the fault. Indeed, here the throw would seem to take a sudden increase for a short distance, and probably amounts to nearly 200 yards; so that to reach the Silurian strata on the north side of the fault a depth of nearly (if not quite) 400 yards from the surface would have to be attained, and this thickness seems to correspond approximately with the combined thickness of the limestone and Millstone Grit beds, as determined by their respective outcrops.

It would be but natural to expect, in a case where the vein is a fault-fissure, that the deposits of ore would be of a particularly irregular character, and this is the case at Minera. The vein-fault is, indeed, in the highest degree "bunchy"—at times swelling out into immense masses of ore and gangue, the latter chiefly consisting of pulverulent quartz and calc-spar—and then again becoming "nipped up" and extremely poor. A good instance of this is to be found at Andrew's shaft, where, in driving the deep adit level on the vein, it required, for scores of fathoms, the keenest and most practised eye to determine whether there existed a vein at all, which yet, in the short distance of two or three fathoms, suddenly opened out to a large size, and made a rich bunch of ore, which continued very productive, both in length and depth, for a considerable distance.

The old vein is also subject to many sudden turns, which give it anything but a regular appearance upon paper. On looking at the plan of the workings, it is difficult to believe that the short curves in the levels proceed from the regular exploitation of the orey portions of the vein. It is true that some of these irregularities proceed from following ore branches in portions of the vein where it is of great size; thus, near the old Speedwell shaft the vein is, probably, in places, from 12 to 15 yards through, and so again at Ellerton's shaft, and near Andrew's shaft the vein not unfrequently attains a

width of from 5 to 8 yards—in such cases two or more levels at the same depth may be observed, since a good branch of ore may be found traversing boths walls of the vein, while the intervening space is poor or contains only lenticular masses of ore. The general uncertainty of the occurrence of these runs of ore has led to the adoption of a regular system of cross-cutting the lode at very short intervals, from which excellent results have been obtained. Very frequently after following a branch of ore worth 60*l*. or 80*l*. per fathom, which, with its accompanying vein stone, is enclosed between two faces vastly like the regular walls of a lode, if a cross-cut be put out it will be found to pass for 2 or 3 fathoms through a confused mass more or less brecciated—of limestone, hard shale, and gangue, when another equally valuable branch of ore will probably be found, also enclosed between regular faces; a continuation of the cross level has even at times discovered another and third branch of lead ore under similar circumstances. If continued, the cross-cut would ultimately reach the hard dry black shales, showing the limit of the vein, for such is the nature of the country north of the Old Vein in the East End mines.

The dip of this vein is about N.E. (true) angle averaging 80°; it therefore courses about S.E. and N.W. Previous to splitting up, as it does in the West End mines, it takes a slight curve to the west, coursing here about N.W. by W. (true). Towards Grand Turk and Busy Bee shafts it bifurcates, and branches run off from it which may be considered true veins; indeed it is here that, for the first time, anything of a character analogous to the regular lode of Cornwall is found. These offshoots course regularly, have distinct walls enclosed by regular limestone country, and have in many instances been remarkably productive. Although this Old Vein may, in a mining sense, be considered as a lode, yet I must still dwell upon its real character—*i.e.*, a fault fissure filled with mineral matter as distinguished from the two veins in the west end of the sett. As the fault caused by this Old Vein as it continues west decreases very considerably in its throw; the limestone here is the surface rock on both walls of the veins. The measures, however, are not thick in this locality, for at the Busy Bee shaft, in the centre of the West End mines, the depth from the surface to the "Blue Stone" (the local name for the Silurian Slate), is only about 120 yards, and this depth rapidly decreases as we proceed westward. The thickness of the limestone varies however materially, and frequently most irregularly, being seemingly to a great extent determined by the vein which may traverse it at the point of observation; every vein at Minera having some throw or dislocating effect on the strata. In this respect we trace an analogy between the Minera Veins and those of Alston Moor.

Further west the veins undergo another change; they become themselves much poorer, but act as the feeders to numerous "Flats," "Pipes," or similar irregular deposits. Under these conditions some remarkably fine deposits of ore have been found, and the enormous cavern-like excavations in Maesyffynnon and Llyn Ddu sufficiently attest the truth of the statements which have been handed down to us in respect to them. In this part of the mine

the "ground" is a hard and compact white limestone, and the ore deposits are almost totally unaccompanied by vein stone of any kind. The veins here are very open and form channels for the passage of immense quantities of mud, sand, and water, which in rainy seasons pour through them. Some natural fissures are also found in connection with these veins, one of them being remarkably extensive. Still further west, near the sett termed Central Minera, the bottom measures of the limestone crop out and the Silurian are at surface, and as the latter rocks are entirely destitute of even the veins the metalliferous district ends here. In these extreme western measures of the limestone, even the thinness of the beds appears to render any deposits of ore which may occur in them small and comparatively unimportant; indeed any ore that occurs here is generally confined to small "flats."

(To be continued).

Illustrated Notes on Prominent Mines.

BY THE EDITOR.

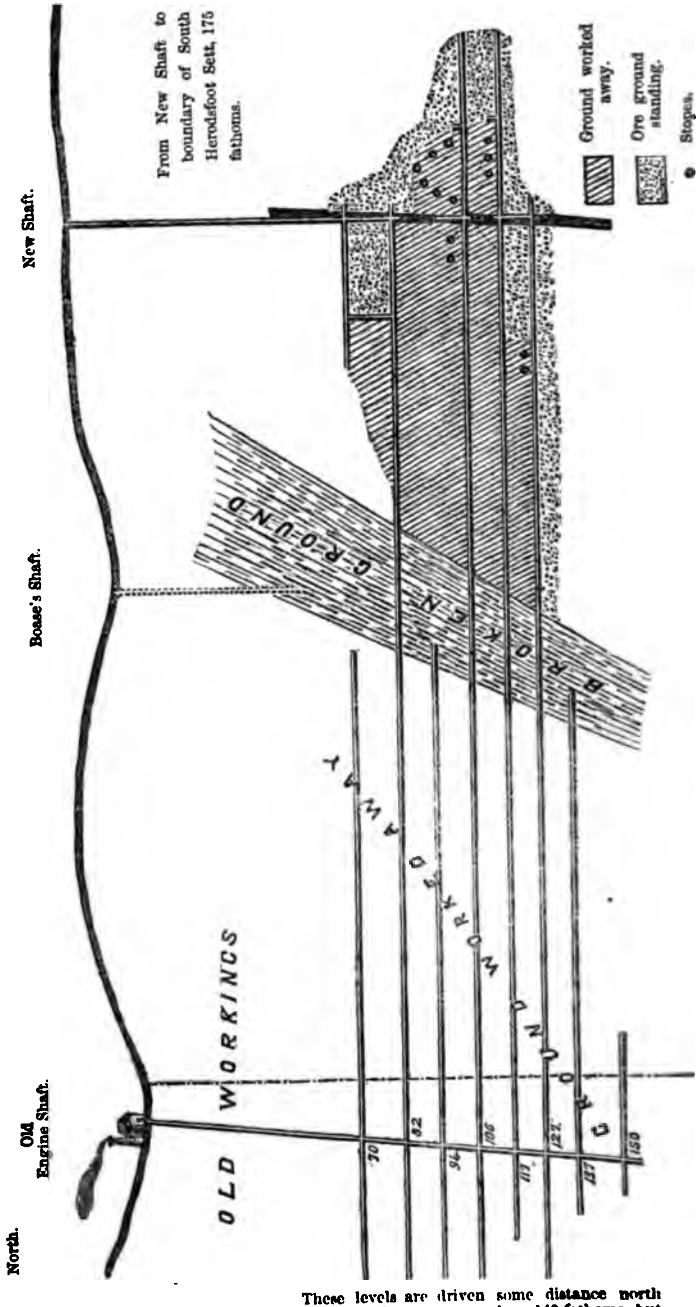
HERODSFOOT MINE.

THE lead mining district in the neighbourhood of Liskeard has, of late years, been one of considerable economic importance. It is rather a scattered district, extending in the killas in a zone about 8 miles long, from 4 miles E.N.E. of Liskeard to about the same distance S.W. of that town, flanking on the south the Caradon granite range at a distance varying from 2½ to 5 miles. The lodes which produce lead ore in this zone have an approximate bearing north and south, while the copper lodes northward course nearly east and west. There is nothing peculiar in this circumstance, for as a general rule lead in Cornwall occurs in lodes running north and south approximately at right angles to the east and west copper lodes.

Within recent years lead mines have only been profitably wrought in this district on lodes in three localities—at Herodsfoot, about 3½ miles S.W. of Liskeard; at Mary Ann and Trelawny, about 2½ miles E.S.E. of Liskeard; and at Wheal Wrey and Ludcott, about 3½ miles E.N.E. of Liskeard. As in each of these localities the profitable workings have been confined to one lode, we may say that the productive lead district of Liskeard has been confined to three lodes, each situated at some considerable distance apart from the other.

Of these localities the most ancient is Herodsfoot, which, indeed, for copper or lead, is the oldest mining work in the neighbourhood of Liskeard. The mine is rather curiously situated at the confluence of four steep valleys, through the principal of which the river Duloe flows nearly due south to its junction with the Looe, a little above the town of that name. At Herodsfoot, which is an old hamlet with

Fig. 1.—SECTION OF HEREDSFOOT MINE. Scale 60 fathoms to 1 inch.



These levels are driven some distance north of shaft, some as much as 140 fathoms, but this part is now abandoned.

a new district church, the confluence of these valleys forms the junction of the parishes St. Pinnock, Lanreath and Duloe—in the two first named of which the workings are situated.

With regard to the original working of this mine, which commenced about sixty years ago, it is unnecessary to say more than that it resulted in large returns from shallow workings in the valley.

The extent of these workings is not now known, but their position is shown in the accompanying section, Fig. I. During the present working, which commenced seventeen years ago, various parties have been connected with the mine. It was originated by Mr. W. D. Boase, solicitor, of Liskeard, the resident agent being Captain John Medlin, now agent at Trevennen and Tremenhere. Mr. Boase was succeeded, as purser and manager, by Mr. James Wolferstan, of Plymouth, who occupied that position until about three years ago, when he was succeeded by Captain Thomas Trevillion. During Mr. Wolferstan's direction, Captain James Seccombe (now at East Caradon and Marke Valley) was for some time the managing agent, but, the mine being poor, he left it, in January, 1855, to go to Tretoil and Messer.

To go into the history of the working of the mine would extend this notice beyond the limits at my disposal. The ore made shallow in the valley, and for some extent into either hill north and south of the engine-shaft, but for some time the bottoms have been poor and abandoned, and the water is now up to the 137 fathom level. Going both north and south, the lode encountered channels of "broken-ground," which are so characteristic of the lead lodes of this district. Northward some of the levels have been pushed 140 fathoms from the shaft, but this part of the mine has been long since abandoned: another sett called North Herodsfoot is working on a small scale in this direction by Mr. Boase and Mr. Richard Hingston, also a solicitor of Liskeard, with the prospects which I shall point out further on. The section shows how the levels are driven southward to, and through, the broken ground in that direction. When this ground was first met with in the levels, the prospects of the mine were very gloomy: the old bunch of ore was evidently gone in depth, and in both ends the lode seemed shattered beyond recovery. The nature of this "broken" or "slidy" ground met with in connection with the lead lodes of this district is very remarkable, and well worthy of attention—for it seems to hold all through the district, being equally met with at Mary Ann as at Herodsfoot. The whole strata seems broken up by a succession of disturbances, of a nature between cross-courses and slides. They are generally called "slides" in the district, although they are not slides in the proper meaning of the word as used in West Cornwall; but neither are they exactly cross-courses. This broken ground generally extends for a considerable width, shattering and indeed obliterating the lodes to a great extent; although now and then detached pieces—sometimes rich—are found in it. Its width in Herodsfoot is shown in the section; by which it will also be seen that it shortens in depth, as, in my experience, I have found to be almost invariably the case in broken channels of ground of this kind. The mine was nearly abandoned at this period, but fortunately the hopeful counsels of Captain Trevillion prevailed

and the adventurers persevered; the broken ground has been passed through, and what is to all intents and purposes a new mine has been opened out south. Practically the old mine, to the north of the broken ground, has been for some time abandoned: all the present workings are to the south, in the neighbourhood of the new shaft, upon which it is proposed, in the course of a year or so, to erect a new 60-inch engine. When this is done, the old shaft—which is now inconveniently distant from the present workings—will be entirely abandoned, and the whole operations transferred south. The whole of the working part of the mine is on the lands of Sir John Trelawny; but, as shown in the section, his ground does not extend quite to the old engine-shaft, which is in another lord's land.

From this it is at once evident that the recent working of Herodsfoot has been abundantly simple. The old levels had merely to be extended from the north mine, through the broken ground, into the new southern run of ore ground. In this manner the 82, the 106, the 117, and the 127 have been driven to, and some beyond, the new shaft. The driving of the 137 south has been suspended in the broken ground, as for obvious reasons it is more advisable now to open out from the new shaft than to communicate the bottom of the mine with a shaft which will shortly be abandoned.

Besides the great run of "broken ground" already referred to, there is also a channel of slidy ground, shown in the section, in the neighbourhood of the new shaft. South of the first run of broken ground the lode improved for silver, but south of the slidy ground about the new shaft it has again improved in this respect—the lead ore from Herodsfoot being among the richest now raised in the kingdom, the last parcel having sold at the rate of 28*l.* 7*s.* 6*d.* per ton. In the old mine the produce of the lead for silver was low, rarely exceeding 12 oz. to the ton, but the produce for lead was very good, averaging 16. The ore at present yields as much as 70 oz. of silver, but on the other hand, it is curious to observe that the produce for lead has fallen off to 14½–15. The assays of the four last "best" parcels sold from this mine have been:—

14⅜ lead, 68 ozs. silver.	....	14⅞ lead, 70 ozs. silver.
14⅝ „ 69 „	....	15 „ 67 „

The only ends now driving in the mine are the five that are being extended south, from the new shaft—the 70, 82, 106, 117, and 127. Two of these, the 106 and 117, are extended about the same distance, 60 fathoms, south of the new shaft, to within about 115 fathoms of the boundary; the other three are only a little south of the shaft. The 70 (driving by two men) is now 5 fathoms to the south of shaft, and has a good lode in the end: the 82 (also by two men), only 1 fathom in from the shaft, is also in a fine lode: in the 106 end (by two men) the lode is divided into numerous orey branches, and a cross-cut is now being driven south to intersect them all, the produce of the whole as far as seen being estimated at 15 cwt.; the 117 end (by two men) is now worth only 8 cwt. per fathom, not being so productive as it has been; and in the 127 (bottom) end (driving by four men) the lode is scarcely yet out of the slidy ground, but is evidently coming into a kindly lode.

The shading in the section shows the ground worked away in the southern part, while the dotted portion shows what is now standing. By this it will be seen that here the ore did not make shallow—indeed in this part of the sett the lode does not "back up," and can scarcely be traced above the 100. At the back of the 106, 117, and 127 there are at present thirteen stopes working, the position of each of which is indicated by the circular marks (o) in the section. Of these, nine are working at the backs of the 106 and 117, south of the new shaft—the six working at the back of the 106 being up respectively, $5\frac{1}{2}$ fathoms, 12 fathoms, 15 fathoms, 12 fathoms, 10 fathoms, and 9 fathoms from the level. The stopes at the back of the 127 are worthy of notice, as the southern one is working on an exceptionally rich lode—one worth some 2 or 3 tons to the fathom, the ore ground being from 2 to 3 feet wide. The lode at one part of this stope is of a large grain not very rich for silver, but a little further north it suddenly changes to a very fine grained ore highly argentiferous, making in a brecciated lode, very similar altogether to the rich lead ore found in the Goginan district, in Cardiganshire. This stope is worked within 2 fathoms of the 117; but the one to the north has got 6 or 7 fathoms yet to get to that level. The ore ground standing is sufficiently indicated by the dotted space to render any particular description unnecessary.

The bearing of the Herodsfoot lode varies from 20° to 35° W. of S. (magnetic) or a few degrees to the west of true south, and its underlie is west about 1 in 6 or 80° from the horizon. The average value of the ground is from 8 to 9 cwts. per fathom.

Until very recently there was only one shaft in the mine, and even now the engine shaft is the only one in regular working. Boase's shaft was never any use; indeed its sinking was a complete mistâke, as it was put down in the *east* of lode which underlies *west*. The new shaft was not originally sunk for an engine shaft, but is now being arranged for one. There being no very great pressure for it, the work has been carried out very economically—indeed everything is done economically at Herodsfoot;—for in fact the ground is first worked away, and the shaft is afterwards carried down through the gunnies. It will be seen by the section that the ground is now nearly communicated, so that, working leisurely (and consequently economically) the shaft may be completed to the 127 in about a year When this is accomplished of course the shaft will be commenced to sink.

It must always be understood that *cæteris paribus*, the greatest element in the value of a mine is the proportion that its *profits* bear to its *produce*. Two mines may give the same annual profits—say 5,000*l.*—but one may give it on a return of 100,000*l.*, while the other may give it on a produce of 10,000*l.*: in fact one may leave only a profit of 5 per cent. on the produce, while the other leaves 50 per cent. In the case of the former mine a drop of 5 per cent. in the prices of ores, takes away all the profits, while it scarcely affects the latter mine. Consequently the class of mines leaving only a small margin of profit are inferior as investments to those of the class leaving a large margin. Among the latter class Herodsfoot occupies probably the highest position of any Cornish mine, for its

present profits rather exceed two-fifths of the value of its returns. At the last account, the value of the lead ores sold for four months amounted to 4,705*l*., out of which a profit was realised of 1,892*l*. 7*s*. 3*d*.

There can be no doubt that the existing prosperity of Herodsfoot mine is due almost entirely to the energy and judgment of the present manager and purser, Captain Thomas Trevillion. He has been now the resident manager for twelve years; and for the last three years, since Mr. Wolferstan has left, he has been purser also. I believe there is scarcely a mine in the county so economically worked, which is no doubt to a great extent due to the returns being kept well within the resources of the mine. Where a mine is pushed—where six men are kept in every end, and every bit of ore ground is set to take away by large pares the moment it can be got at—the expences increase in an enormous proportion, and the *ultimate* profits diminish. It would be well if London speculators could be made to see this: at present they seem to be the great supporters of the opposite system, which tears away and pours into the market as fast as posssible every ton of ore at all get-at-able, but which can only be done at an enormously increased proportionate cost. Under this system no doubt greater immediate profits may be realised: 50,000*l*. or 60,000*l*. profit may be made out of a bunch of ore in four or five years—at the rate, say of 12,000*l*. a year;—whilst under a more regular system of working a profit of 80,000*l*. or 90,000*l*. would have been extended over nine or ten years—giving only 9,000*l*. a year. This is assuming a moderate case, for it would not be difficult to find instances of much larger proportions of profits wasted by this "fast" working. It however suits share-jobbers, for the public seem to buy mines at so many years purchase irrespective of the rate at which they are worked; and as a certain class of Cornish mining seems to be daily drifting more and more under the control of jobbers, we must, I fear, expect these things to increase rather than otherwise for a time. I say *for a time*, for every abuse ultimately works it one cure, although in the meantime it causes a great deal of mischief.—A mine like Herodsfoot, returning only 40 tons of lead per month, and yet giving upwards of 5,000*l*. a year profit, has with ordinary luck a long future before it.

To the south of Herodsfoot, 175 fathoms south of the New shaft, comes in the sett of South Herodsfoot, which is situated in the parish of Duloe—the boundary between Lanreath and Duloe being the boundary of the setts. This sett belongs to Mr. Wolferstan, and a small double engine has recently been put to work here. It is not easy to say what the prospects of this sett are, for the nearest end in Herodsfoot is 115 fathoms off—a long way for a lode to hold good. The principal difficulty, however, likely to be encountered here is from the lode not "backing up," which will probably necessitate going to a considerable depth working rather at sea. If the Herodsfoot people had to find their southern mine from surface instead of driving their deep levels into it, it is very doubtful if they ever would have succeeded. However, when the Herodsfoot ends get nearer the boundary, their neighbours will be in a better position to know what to expect and what to be at.

The same to a certain extent applies to North Herodsfoot. The shallow trials have hitherto failed to discover anything definite, and probably the best plan of working this sett would be to take up the Herodsfoot old mine, and drive on the northern levels into the new ground.

The following are the particulars of the returns from Herodsfoot Mine during the present working. From November, 1847, to the 27th September instant, 9,648 tons 5 cwt. of lead ore have been sold, realising 146,992*l.* 13*s.* 1*d.* Of this 1,898 tons 15 cwt. 3 qrs., realizing 40,691*l.* 19*s.* 8*d.*, have been sold from November, 1859, when the entire control of the mine passed into the hands of Captain Trevillion.

Years.	Weight.			Average price.			Amount.		
	Tons.	cwt.	qrs.	£	s.	d.	£	s.	d.
1848	812	9	0	12	10	0	10,237	1	2
1849	1,051	9	3	11	10	0	12,230	19	4
1850	833	0	0	12	10	0	10,542	6	6
1851	833	1	0	12	0	0	9,938	7	0
1852	663	0	0	12	5	0	8,201	10	0
1853	713	10	2	16	0	0	11,461	7	3
1854	571	10	2	15	5	0	8,603	13	3
1855	298	10	2	14	0	0	4,165	14	11
1856	359	0	0	15	0	0	5,430	0	0
1857	513	7	0	16	10	0	8,485	10	2
1858	508	0	0	16	4	0	8,274	19	6
1859	472	0	0	21	3	6	9,995	12	6
1860	585	15	0	22	10	0	13,137	11	8
1861	635	19	3	22	2	6	14,061	3	0
1862 (to September) ..	597	1	0	20	15	0	12,101	10	0
	9,648	5	0				£146,992	13	1

In giving the average price per ton of the ores for the last three years, it must be understood that large parcels of second quality are included, only realizing from 2*l.* 10*s.* to 6*l.* 10*s.* per ton. For 1860-1-2 the best parcels have averaged 27*l.* per ton. This only applies to the last three years, for before 1860 there was no parcels of second quality.

Since the end of 1859, that is during the period of Captain Trevillion's management, the following profits have been divided:—

	Per Share. £ s.	£
1860. Feb. 1 ..	1 0 ..	1,024
„ June 5 ..	1 10 ..	1,536
„ Oct. 3 ..	1 10 ..	1,536
1861. Feb. 5 ..	1 15 ..	1,792
„ June 4 ..	1 15 ..	1,792
„ Oct. 1 ..	2 0 ..	2,048
1862. Feb. 4 ..	1 15 ..	1,792
1862. June 3 ..	1 15 ..	1,792
„ Oct. 7 Will be declared	1 15 ..	1,792
		£15,104

As there will be a balance in hand of upwards of 1,500*l.* after paying the dividend in October, this shows as near as possible a profit of ⅞ths on the value of the produce sold.

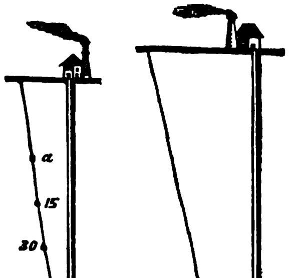
WHEAL MARY ANN.

This mine is worked to the south of, and on the same lodes as, Wheal Trelawny, in the parish of Menhenoit, in the general position I have already described. Taken together with Trehane (now in Trelawny sett) these mines have, next to East Wheal Rose, probably afforded the most productive piece of lead ground in the county; and even at present, at a depth of upwards of 200 fathoms from the surface, the lode is nearly as productive as ever, although the expenses having increased with the depth, the profits now form but a small proportion of the value of the produce.

The general bearing of the lode is from 20° to 25° W. of S., with an average underlie east of about 15 inches in a fathom. The extent of the workings are sufficiently shown in the section (Fig. 2) on the opposite page, by which it will be seen that at the deepest point—the bottom of Clymo's engine-shaft—the workings extend to the nominal depth of 186 fathoms below adit, or 216 fathoms below the surface. I say nominal depth, because the real depth is probably fully 10 fathoms deeper, inasmuch as many of the levels are nearly 11 fathoms apart. In the northern part of the sett, adjoining Trelawny boundary, about Barratt's shaft, the ore made up to grass, and, as will be seen by the section, all the levels above the 140 inclusive are either communicated to that mine or are close up to the boundary. Southwards the lode is cut off in the lower levels by the slidy ground which I shall refer to bye and bye, but in this part it does not "back up" at all, and is not traceable shallow: behaving, in this respect, like the Herodsfoot lode going south.

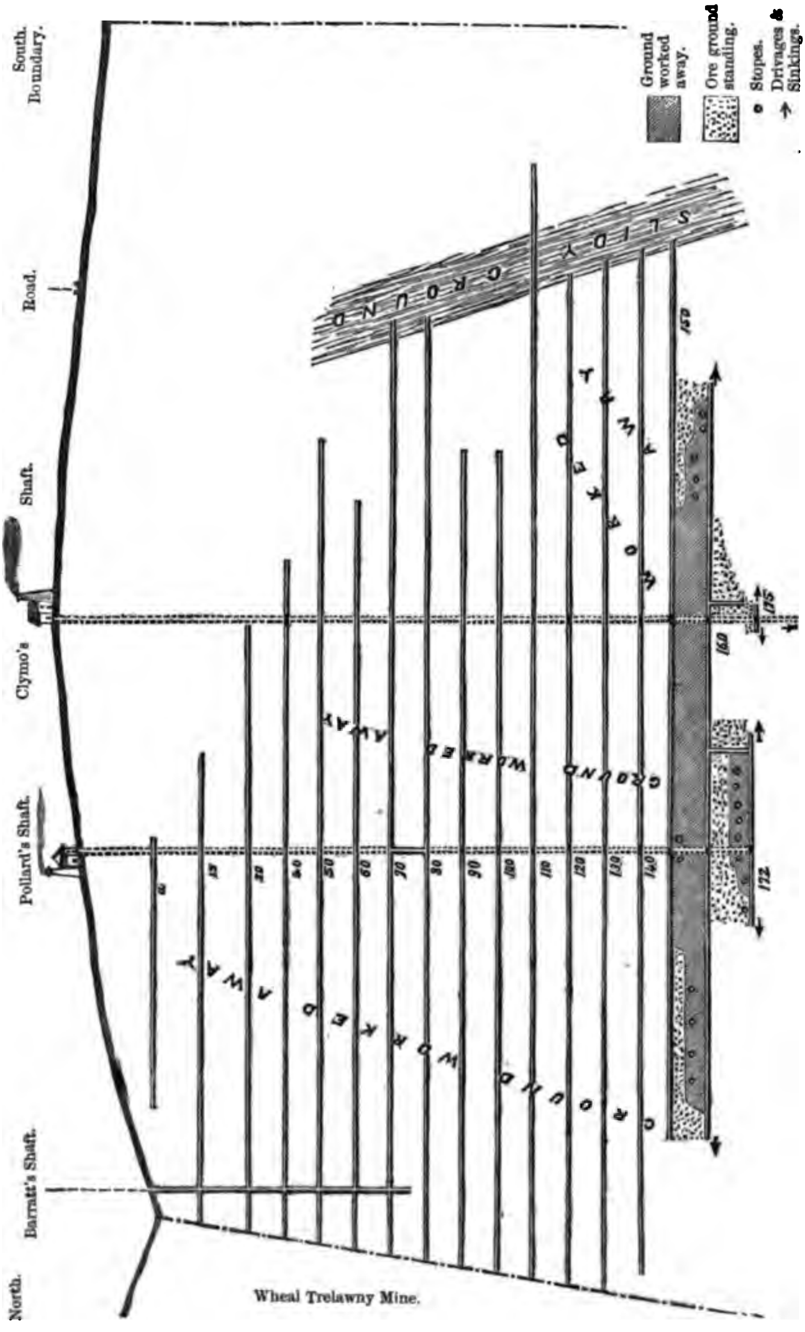
Fig. 3.

Transverse Section at Pollard's and Clymo's shafts.



Scale: 60 fms. to 1 inch.

Of the three shafts shown, Barratt's is sunk on the course of the lode, but Pollard's and Clymo's are vertical all the way—crossing the lodes as shown in the transverse sections Fig. 3. Speaking generally, all the ore ground, with the exception of some arches and low quality ground, which will come away on high tribute, is gone above the 150. Above this level there are certainly twenty-one pitches working, but they are all at a high tribute—averaging 13*l*. per ton. The substantial ore ground is entirely in



Wheal Trelawny Mine.

the bottom of the mine, below the 150, and it is all working by stopes—of which there are about twenty—with the exception of a few arches of ground that are being taken away by two pares (a man and a boy each) at 12*l.* tribute on either side of Pollard's below the 150. Consequently it will suffice for us here to consider the levels below the 150—viz., the 160 and 172.

The 160 is communicated, as shown, from shaft to shaft (between which the ground is all gone) and is besides driven considerably north and south of Pollard's and Clymo's respectively. The 160 south of Clymo's is extended about 75 fathoms from cross-cut from shaft, and is now being driven by six men at 3*l.* 10*s.*, in a lode worth 8 cwt. per fathom. For the whole of this distance the lode has been orey, averaging probably from 5 to 7 cwt. per fathom—but at some points reaching as high as 20 cwt., and at others falling as low as 2 or 3 cwt. The proportion of ground gone and still standing in this length, as well as the stopes working, is shown in the section, Fig. 2. Behind the end there is 5 fathoms of whole ground. In the 13 fathoms following this there are two stopes, worth 6 cwt. per fathom, working by four men each at 30*s.* and 35*s.* respectively, but which, however, are not beaten away more than 1 fathom up. In the 22 fathoms succeeding this three other stopes are working, worth 6 cwt. per fathom, one by six men and two by four men each: the lode in this run of stopes is large, being fully 5 feet wide, composed of fluor-spar ("can") interspersed with lead, with a band of calc-spar, of ribboned structure on the west wall. Between this and the shaft the ground is gone to the 150.

The 160 north of Pollard's is extended about 92 fathoms north of that shaft, to within 55 fathoms of Trelawny boundary, and is now driving by four men at 10*l.* per fathom in a lode 2 feet wide, producing 3 cwt of lead per fathom. For the first 30 fathoms from the cross-cut the lode is beaten away to the 150; but for 13 fathoms back from the end the ground is whole. Between these there is 49 fathoms of ground in course of taking away in four stopes of four men each, worth on an average 5 cwt. per fathom: these are worked up on the whole about 7 fathoms from the level.

The 172 from Pollard's and the 175 from Clymo's are within 30 fathoms of being communicated, and this is expected to be accomplished within the year. At Clymo's the lode has not long been intersected in the cross-cut, only 4 fathoms each way having been opened on it, which, however, has been entirely through orey ground. The 175 south is driving by six men at 3*l.* 10*s.* per fathom, in a lode from 6 to 8 feet wide worth 6*l.* to 7*l.* per fathom. The present end is not so good as it has been, the lode being disturbed by a slide which has been seen in the upper levels and dips north. The bearing of the lode in this end is out of its normal direction, being nearly north and south.—The 175 north is also driving by six men at 3*l.* 10*s.*, in a good lode worth 7 cwt. per fathom, in a pretty killas. The lode in this end has its normal bearing of S. 20 W.—A winze (shown in the section) is sinking below the 160 to come down on the 175 south: it is now down about 9 fathoms, and is 8 feet a-head of the end. The lode in this winze for the whole depth has averaged 6 cwt. per fathom.

The 172 south from Pollard's is extended about 35 fathoms south of cross-cut from shaft, now driving by six men at 14*l.*—in the killas by the side of the lode, the latter being still harder, consisting of 1½ feet wide of "capels" and 1 foot of fluor-spar with a little carbonate of lime. For the first 25 fathoms south of Pollard's this level passes through a lode worth on an average 2 tons to the fathom, which has gone down in the bottom: the last 10 fathoms have not been so good—varying from 10 cwt. to 15 cwt., and averaging probably 12 cwt. About 30 fathoms from the cross-cut from shaft, and 5 fathoms back from the end, a winze has been communicated from the 160; and between this winze and the cross-cut there are five stopes working by twenty-four men at a mean of 4*l.* per fathom, on a lode producing 6 cwt. On an average these stopes are worked up 5 fathoms from the level, but as there is really 12 fathoms of ground between the two levels, there is still 7 fathoms standing. This level is being driven dead, while the 170 from Clymo's will have a rise of 3 fathoms, so that the water may all flow to that shaft.

The 172 north of Pollard's is extended 25 fathoms from the shaft, and now driving by six men at 14*l.*—in a lode 4 feet wide composed of carbonate of lime and fluor-spar worth 6 cwt. per fathom, with 2 feet of "capels" on the west side. For this length of 25 fathoms the first 15 fathoms from the cross-cut will yield on an average 10 cwt. per fathom, and the last 10 fathoms to the end, about 6 cwt. In this distance three stopes are working: one, 7½ fathoms long from cross-cut, by four men at 90*s.* per fathom, up 6 fathoms; another, 6 fathoms long, by six men at 80*s.*, up 3 fathoms; and a third, just pitched, by four men 90*s.* These, three stopes will average about 6 cwt.

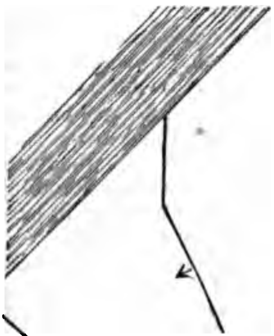
Clymo's shaft is at present sinking by twelve men at 28*l.* per fathom, and is down 11 fathoms. In the bottom of this shaft there are two 8-inch buckets lifting the water to the 160, at which level it flows back to Pollard's. In this latter shaft there is one 8-inch bucket, and two 9-inch poles which raise the water by a "shammel" lift to the 110, where it goes back again to Clymo's: from the 110 at Clymo's it is brought to surface by four 13-inch poles. When the 172 is communicated, all the lifts in Pollard's will be done away with, and the drainage of the mine effected entirely through Clymo's. The present engine at Pollard's—a 46-inch—will then be done away with, for the engine on Clymo's shaft—a comparatively new 80-inch—has ample power to put the mine considerably deeper. This Clymo's engine, which is one put up by Mr. West, of St. Blazay, is among the finest in the county, and is kept in splendid order; but as yet it has done very little work, although it has been erected eight years. There are double skip roads in both shafts.

This lode, which here and in Trelawny has certainly been remarkable for its productiveness, is a large and strong one containing a great deal of fluor-spar and carbonate of lime—with capels generally on both sides, varying from 1 foot to 6 feet wide. No productive parallel lodes have been met with—indeed no cross-cuts have been driven in Mary Ann Sett—but trials have been ineffectually made in Trelawny and Trehane.

One of the most remarkable features, however, in Wheal Mary Ann remains to be noticed—and that is the great run of "slidy"

ground, which cuts off the lode southward. This is shown in the section, Fig. 2, dipping south; and altogether it is very similar to the broken ground already described in Herodsfoot, although it seems to be wider, for as yet, unfortunately, it has not been got through in Mary Ann sett although an extensive trial has been made to this effect at the 110 fathom level. The first effect on the lode of the approach of this slidy ground is that, as shown in Fig. 3, it is thrown to the right, with a bearing W. 45 S. After the slidy ground is intersected, the lode has not been again seen, although the 110 has been driven, as shown in Fig. 4 (on a scale of 25 fathoms to 1 inch) considerably south and also east and west. Some branches were more than once met with, but they soon disappeared again, and at present the trial is for the moment suspended. The importance, in the interest of the future of Mary Ann, of a dis-discovery in this direction is too obvious to need pointing out. This mine would then be in the position of Herodsfoot—having only to drive up deep levels into a new mine, for although the present limits of the sett south is the boundary shown in the section, Fig. 2, any required extent of ground can be readily had further south towards the village of Menheniot.

Fig. 3.



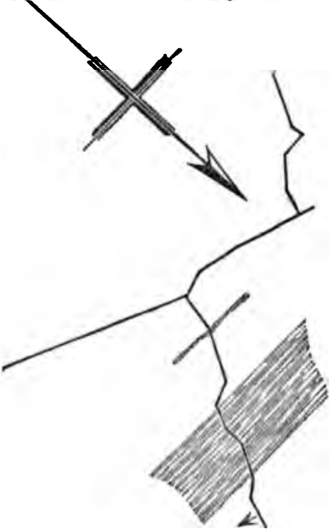


Fig. 4.
Scale: 25 fms. to 1 inch.

Wheal Mary Ann has now been working sixteen years last May, and during that time she has made splendid returns and excellent profits. The present returns are about 60 ton per month of best ore and 25 tons of seconds — the former worth about 25*l.* and the latter 10*l.* per ton. But when a mine—and particularly a lead mine—has to get all its returns from upwards of 200 fathoms deep, and to have to continue sinking pretty smartly to keep them up, profits generally become "small by degrees and beautifully less." With the present excellent management the bottoms may continue to be worked with profits for some years longer, but expenses must gradually increase, and profits diminish in a like ratio. The great future of this mine would be a discovery south, which would give it a new start. It is difficult to form an opinion as to the probability of such a discovery being made, but there are certainly fair chances.

This mine is under the management of Mr. Peter Clymo, of Liskeard, the manager of South Caradon, and also until recently the manager of Trelawny. The agents are Captain Henry Hodge (managing), and Captains Joseph Harris and James Stephens. Besides the two pumping engines mentioned, there is a 24-inch double whim engine drawing from both shafts; a 22-inch horizontal engine for crushing and stamping; and six water wheels worked by the water pumped from underground.

Abstracts and Reviews.

THE *REVUE UNIVERSELLE.*

Revue Universelle des Mines, de la Metallurgie, de Travaux Publics, des Sciences et des Arts, appliqués à l'Industrie, sous la direction de M. Ch. de Cuyper, Professeur Ordinaire à la Faculté des Sciences de l'Université de Liége. Sixth year, 4th livraison, July and August, 1862. Paris and Liége, E. Noblet, à Paris, rue Jacob, No. 20.

THE contents of the 4th *livraison* of the *Revue Universelle* are not quite so varied or interesting as those of the preceding numbers of the year, and many are derived from English sources. They consist of:—

1. Fours et fourneaux comparés (*suite et fin*) par P. Havrez, ingénieur des mines.
2. Sur un nouveau système de fours à coke, appliqué au menu du Staffordshire (*suite et fin*) par B. Cochrane.
3. Fours régénérateurs de Siemens.
4. Des matières colorantes extraites du goudron minéral, par W. H. Perkin.
5. Poudre: Appareil de sûreté pour les moulins à meule.
6. Bulletin: Analyses de l'école des arts et manufactures et des mines; Nouveau procédé de fabrication de la poudre des mines, par N. Bennetts; Statistique minérale de l'Angleterre, par Mr. Robert Hunt; Avantages et désavantages de la condensation par surface, par Mr. John Frederick Spencer.

THE ROYAL SOCIETY.

Proceedings of the Royal Society. Vol. XII, No. 51. London: Taylor and Francis, Red Lion Court, Fleet Street.

This number of the Proceedings of the Royal Society contains abstracts of twenty-one papers, many of them of considerable general interest. One of the most interesting and important—Mr. Crooke's paper on the new metallic element, Thallium—we give *in extenso.* The other papers of interest are:—On the Reflexion of Polarized Light from Polished Surfaces, by the Rev. Samuel Haughton, M.A., F.R.S.; On the Loess of the Valleys of the south of England, and of the Somme and the Seine, by Joseph Prestwich, F.R.S.; On the simultaneous Distribution of Heat throughout superficial parts of the Earth, by Prof. H. G. Hennessy, F.R.S.; On the Sulphur Compounds in Purified Coal Gas, by the Rev. W. R. Bowditch, B.A., F.C.S.; On the Forces concerned in producing the larger Magnetic Disturbances, by Balfour Stewart, M.A., F.R.S.; and On the Oxidation and

Disoxidation affected by the Alkaline Peroxides, by B. C. Brodie, F.R.S. There are also several papers on the spectrum and on mathematical subjects; a paper by the Rev. W. Michell, On the Geometrical Isomorphism of Crystals; and two papers on the transmission of the Electric Wave through Submarine Cables. Prof. Haughton's paper contains an account of experiments made to determine with precision what the author calls the Coefficients of Refraction and Reflexion, of a plane-polarized beam of light incident on a polished surface, upon which depend respectively the *brilliancy* and *lustre* of these surfaces. These experiments were made on certain transparent bodies, such as glass and quartz crystal; on twelve pure metals; on one alloy of copper and tin; and on fourteen alloys of copper and zinc, ranging in composition from 10 Cu + Zn to Cu + 5 Zn. The results show that transparent bodies, as well as metals, possess a coefficient of reflexion, sometimes very sensible. Of the metals, *silver* is the only substance possessing the combined qualities of *brilliancy* and *lustre* in a high degree; *Mercury*, *Palladium*, *Zinc*, and *Iron* have a high *brilliancy* but little *lustre;* while *Gold* and *Copper* have a high *lustre* but little *brilliancy*. The alloys also show results of the highest interest; and on whole the result seems to the author to indicate laws which appear to require notice from theorists.

Mr. Prestwich's paper, in discussing the origin of the Loess, enters collaterally upon many questions of great geological interest regarding the former conditions of river-valleys. The papers of Messrs. Hennessy, Bowditch, Stewart, and Brodie are all important on their respective subjects.

THE *GEOLOGICAL JOURNAL.*

The Quarterly Journal of the Geological Society. Edited by T. Rupert Jones, Esq., F.G.S. No. 71, Vol. xviii, part 3. London: Longmans.

This number of the *Quarterly Journal* contains the following papers, or abstracts of papers, read before the Society from February, 26, to April, 16, 1862:—

1. On the Drift containing Recent Shells, in the neighbourhood of Wolverhampton; by the Rev. W. Lister.
2. On a Split Boulder in Little Cumbra, Western Isles; by Mr. J. Smith, of Jordan Hill.
3. On the Ice-worn Rocks of Scotland; by Mr. T. F. Jamieson.
4. On the Glacial Origin of Lakes; by Prof. A. C. Ramsay.
5. On the Sandstones and their associated Deposits in the Vale of the Eden, the Cumberland Plain, and South East of Dumfriesshire; by Prof. R. Harkness.
6. On the Date of the Last Elevation of Central Scotland; by Mr. A. Geikie.
7. On some Fossil Chitons from the Mountain-limestone of Yorkshire; by Mr. J. W. Kirkby.
8. On some Fossil Reptilia discovered in the Coal-measures of the South Joggins, Nova Scotia, by Dr. J. W. Dawson; by Prof. Owen.
9. On the occurrence of Mesozoic and Permian Faunæ in Eastern Australia; by the Rev. W. B. Clarke.
10. On the Footprint of an *Iguanodon*, lately found at Hastings; by Mr. A Tylor.
11. On the Position of the Pteraspis-beds, and on the Old Red Sandstone Series of South Perthshire; by Prof. R. Harkness.
12. On the Western End of the London Basin, the Westerly Thinning of the Lower Eocene Beds in that basin, and the Greywethers of Wiltshire; by Mr. W. Whitaker.

13. On a Deposit with Insects, Leaves, &c., near Ulverston; by Mr. J. Bolton.

Among these, the papers of Messrs. Jamieson and Ramsay, on Glaciers; of Mr. Geikie, on the Last Elevation of Scotland; and of Mr. Whitaker, on the Tertiaries of the London Basin,—will probably be found the most generally interesting.

Professor Ramsay commences by pointing out that the opinion hitherto held by himself, in common with the majority of the most distinguished geologists, on the origin of the blocks of Monthey (in the valley of the Rhone) and the great erratic boulders that strew the southern flank of the Jura, was, that they had been transported thither by *floating icebergs* during the submergence of the low country between the Jura and the Alps: these icebergs being derived from glaciers descending to the sea-level by the Alpine valleys. But, during some recent visits to Switzerland he has seen good reason to change this opinion; and he is now convinced that a vast glacier once flowed from the valley of the Rhone right across the low country now forming the great valley of Switzerland, until its end abutted on the Jura,—by which these blocks and boulders were transported.

The reasons for abandoning the older theories are fully detailed, and seem clearly to establish that those which assumed the *Pierre à bot* and its companion blocks to have been floated from the Alps by marine ice-bergs can no longer be considered tenable; and that we have no option but to believe that the glaciers of the Alps flowed right across the Miocene basin of Switzerland: that the ice which descended the great valley of the Rhone had, at that period of extreme cold, debouched as a glacier of great thickness upon the lowlands at what is now the eastern end of the Lake of Geneva, and spreading in a fan-shaped mass extended to the south-west several miles down the Rhone below the present outfall of the lake, and north-east to the banks of the Aar, considerably above Solothurn. This would give a length of 130 miles by a breadth of 25 miles.

Another great glacier is shown to have descended in an opposite direction, through the upper valleys of the Rhine, debouching on the wide area, the centre of which is now occupied by the Lake of Constance. Between these two giant glaciers several smaller but still enormous ones filled the spaces now occupied by the Lakes Zurich, Lucerne, Zug, and others. To the south of the Alps also several glaciers descended into the plains of Piedmont and Lombardy. For instance, it is shown that the vast circling moraine of Ivrea was shed from a glacier 105 miles long, that filled the valley of Aosta to a height of more than 2,000 feet.

Professor Ramsay next turns to a consideration of the connection between tarns and glaciers, showing that the theory of the glacial origin of many rock-basins must be extended much further than has hitherto been done. Proceeding to inquire into the origin of the great lakes north and south of the Alps—such as those of Geneva, Neuchâtel, Zurich, Constance, Maggiore, Lugano, Como, &c.,—he points out that they do not lie in basins produced by disturbance, but in hollows due to denuding agencies that operated long after the production of the complicated foldings of the Miocene strata.

Examining their special conditions, the author shows: (1) that none of these lakes lie in simple synclinal troughs; (2) that they cannot be due to the mere watery erosion; (3) that few, if any, lie on lines of great fracture; and (4) that it is impossible that they can be assumed to lie in areas of special subsidence. He also shows that each great lake lies in an area once covered by a vast glacier; and as this connection can scarcely be accidental, and as no other agency remains to account for the erosion of the lake basins, he concludes that they were scooped out in the soft rocks below by the enormous weight and grinding power of the flowing glacier passing from the Alpine valleys into the plains.

Passing from the lakes of Switzerland to those of the northern h
phere generally, Professor Ramsay points out that, *going northward*,
become more numerous. He points out that almost all the smaller lal
North America, as well as those of Wales, Cumberland, Ireland, an
Highlands, are all rock basins—occurring in countries bearing the f
evidence of glaciation: Lochs Lomond and Katrine are merely large
of glacier erosion. The same probably will be found true of the lake
fiords of Scandanavia.

"I am, therefore," concludes the Professor, "constrained to retu
least in part, to the theory many years ago strongly advocated by Ag
—that, in the period of extremest cold of the Glacial epoch, great pa
North America, the north of the Continent of Europe, great part of Bri
Ireland, and the Western Isles, were covered by sheets of true glacie
in motion, which moulded the whole surface of the country, and in fa
able places scooped out depressions that subsequently became lakes."

These views are also adopted by Mr. Jamieson in his paper on the
worn Rocks of Scotland. Although when he began a study of the sul
he was disposed to refer the ice-worn appearances in question to the a
of *sea-borne* ice, a careful examination showed him that no modificatio
this agency would meet the requirements of the case; and that, in
great majority of instances, the grinding down of the rocks in Scotland
been caused by the long-continued movement of *land-ice* and *glaciers*.
consequently adopts the conviction of Agassiz, that there formerly exi
in Britain glaciers and large sheets of ice resembling those now exis
in Greenland—the country being then quite above the level of the sea,
probably forming part of an extensive northern continent.

Mr. Geikie's paper on the last elevation of central Scotland is as n
archæological as geological. He apologises for this—not that it needs
—by expressing his conviction that the day is not far distant when arc
ology will form well nigh as integral a part of geological science
palæontology does now.

That the central districts of Scotland have undergone an upward m
ment within a recent geological period is a familiar fact. The object i
ascertain the date at which the later stages at least of this rise t
place.

Hitherto it has been universally believed, and indeed appeared to h
been demonstrated by Mr. Smith, of Jordan Hill, Mr. Chambers,
others—that no change has taken place in the relative position of land
sea within the last 2,000 years, and probably not within the human per
Some observations of Mr. Geikie, in the Spring of 1861, seemed to show
the contrary, that a portion of the coast of the Frith of Forth had b
elevated, not only within the human period, but even since the last
years of the Roman occupation. Observations involving so wid
departure from preconceived opinions necessitated a careful examinatio
other parts of the coast, and a general review of the whole subject.
result of these inquiries is the conviction, on the part of Mr. Geikie, t
the last upheaval of the coast-line of central Scotland must have ta
place long after the first human population settled in the island—long a
metal implements had come into use, even after the introduction of ir
and reviewing the position of the Roman relics, there seems cogent ar
ments for believing that it has been effected since the first century of
era—that that date is the limit of its antiquity.

Mr. Whitaker's paper on the London Basin, throws much new light
some points of the geology of the district, notwithstanding the labour
Mr. Prestwich and others. It is one of those exact papers—teeming w
facts—of which we have received so many from the members of
Geological survey, and which, indeed, without the resources of the surv
would be scarcely possible.

THE BOARD OF TRADE RETURNS.

The "Accounts relating to Trade and Navigation of the United Kingdom, for the month ended 31st July, 1862, and the seven months ended 31st July, 1862," have been issued by the Statistical Department, Board of Trade.

IMPORTS.—The imports of metals and metallic ores for the month ended July 31st, have been as follows:—

		1860.	1861.	1862.
Copper Ore..	tons	5,005	4,880	7,303
Copper Regulus	„	665	3,005	5,882
Copper, unwrought & part wrought	cwts.	30,420	31,080	24,280
Iron, in Bars, unwrought	tons	5,243	5,510	3,593
Steel, unwrought	„	435	162	438
Lead, Pig and Sheet	„	1,515	2,937	2,615
Spelter or Zinc	„	2,848	3,291	2,114
Tin, in Blocks, Ingots, Bars, or Slabs	cwts.	2,890	2,835	6,476
Silver Ore	value in £	3,000	39,292	50,730
Quicksilver	lbs.	89	75,195	—

EXPORTS.—The declared value of the exports of metals, minerals, and metallurgical articles of British and Irish produce and manufactures have been, for the—

	Month ending July 31st.		
	1860.	1861.	1862.
	£	£	£
Alkali: Soda	81,275	47,700	82,472
Coal, Cinders, and Culm	326,000	379,200	384,017
Iron, Pig and Puddled	83,959	94,506	122,400
Iron, bar, Angle, Bolt, and Rod	205,158	140,797	218,183
Railroad Iron, of all sorts..	351,539	268,840	339,124
Iron Wire	20,403	12,709	34,084
Iron, Cast	103,797	69,495	66,701
Iron Hoops, Sheets, and Boiler Plates ..	108,357	70,390	114,252
Iron, wrought, of all sorts	241,975	148,816	192,153
Iron Steel, unwrought	74,965	43,513	86,505
Copper, unwrought in Ingots, Cakes or Slabs	58,645	40,400	52,366
Copper, wrought, or partly wrought, Bars, Rods, Bottoms, Pans, Plates, Sheets, and Nails; and mixed or Yellow Metal for Sheathing ..	200,454	123,891	202,360
Copper, wrought, of other sorts	22,240	24,496	3,887
Brass of all sorts	22,347	13,564	19,051
Lead, Pig, Rolled, Sheet, Piping, Tubing, and Lead Shot	39,411	28,131	62,549
Lead Ore, Lead, Red and White and Litharge of Lead	14,463	11,408	17,695
Tin, unwrought	29,048	28,227	61,652
Tin Plates	134,905	61,064	146,102
Zinc or Spelter, wrought or unwrought ..	10,989	6,204	5,773
Salt	63,014	61,987	61,606

Comparing the value of the exports of these articles for July this year with the corresponding month of last year we find that there is a total increase in value of 597,594*l*. On the separate articles enumerated, the respective increase and decrease has been as follows:—

Increase.—Alkali, 34,772*l.*; coal, cinders, and culm, 4,817*l.*; iron (pig and puddled), 27,894*l.*; iron (bars, &c.), 77,386*l.*; railroad iron, 70,284*l.*; iron wire, 21,375*l.*; iron hoops, sheets, &c., 43,862*l.*; iron (wrought) of all sorts, 43,337*l.*; iron steel (unwrought) 42,992*l.*; copper (unwrought) 11,966*l.*; copper (wrought or partly wrought), bars, &c., 78,469*l.*; brass, 5,487*l.*; lead, 34,418*l.*; lead ore, 6,287*l.*; tin (unwrought) 33,425*l.*; and tin plates, 85,038*l.*

Decrease.—Iron (cast), 2,794*l.*; copper (wrought of other sorts), 20,609*l.*; zinc or spelter, 431*l.*; and salt, 381*l.*

THE CHEMICAL SOCIETY.

The Journal of the Chemical Society, Nos. 54, 55, Vol. XV, Nos. 8 and 9. London: H. Bailliere, 219, Regent Street.

The only papers of interest to our subject in these numbers of the Chemical Journal are—On the general occurrence of Titanic Acid in Clays, and the method employed to estimate it; on the Analysis of Iron Ores and Siliceous Minerals containing Iron, and the methods of estimating Iron: by Edward Riley. And, On the formation of the Iodides of the Alcohol-radicles from Boghead Naphtha: by C. Greville Williams, F.R.S.

Mr. Riley's paper will be found of the highest practical importance to metallurgists interested in the manufacture or chemistry of iron. It is too elaborate to bear abstracting; but as the two numbers of the Chemical Journal which contain it can be had for 1*s.* each, we strongly recommend those interested in the subject to procure them.

Mr. Williams's paper is also noteworthy as bearing on a subject which is daily becoming more important—that is, the products to be derived from the carbonaceous minerals. As to the Boghead naphtha, Mr. Williams says, it is now evident that it may be made to yield an almost infinite variety of products, some of them belonging to organic groups which have hitherto almost escaped investigation.

Correspondence.

CONDENSATION OF LEAD FUMES.

Sir,—I read with great interest the paper in your last number on Mr. Fallize's proposed new form of lead condenser; but I fear it will be found too complicated for general use, and I think a much simpler and equally effectual arrangement might be effected. I now particularly write, however, to say that I do not agree with the statement there made, that silver is not carried away with the fumes to any extent, for it is well known, on the contrary, that the loss of silver is great. Silver alone—as you may see more fully set forth in certain papers read by me before the Chemical Society some time ago—when in fusion is volatile in a greater proportion than is generally supposed, and it is much more so when in combination with metals more volatile than itself. In one of the papers referred to (Remarks on Metallic Deposits found in two Chimneys attached to Reverberatory Furnaces) I give two tables of analyses of soot from chimneys attached to furnaces, which show how large a proportion of silver may be lost by volatilisation.

James Napier, Jun.

Rotherhithe, *Sept. 20th.*

SUBSCRIBER, HULL.—We can offer no opinion on the mines you mention. If, with proper introductions, you stated your case to Messrs. John Taylor and Sons, 6, Queen-street Place, Upper Thames-street, they might possibly allow one of their agents to inspect the Cardiganshire mine for you. In that district we really cannot refer you to any other quarter where you would be certain to receive thoroughly reliable information.

T. E. F.—You will find a list of all the metallic mines in the kingdom, with the names of the principal agents, and the nature and value of their produce, in Mr. Hunt's *Mineral Statistics*. Every one in any way interested in mining should procure Mr. Hunt's annual volume. The statistics of mine brokers, although often not without value, are generally partial, and put forward with the object of recommending certain schemes. Sometimes they are utterly fallacious and untrue.

We are compelled to postpone communications on "Black-band and Clay-band Ironstones," and on "Mine Brokers and the Public."

Notes and Memoranda.

SHEFFIELD SCHOOL OF PRACTICAL SCIENCE AND METALLURGY.—We are gratified to hear that the arrangements of this school are progressing most satisfactorily, and that the Duke of Devonshire has consented to act as Presented. The Executive Committee consists of the Mayor of Sheffield (Mr. Brown) the Master Cutler (Mr. Wilkinson), with Messrs. W. Baker, F.C.S.; C. H. B. Hambly, F.G.S., F.C.S.; Robert Jackson; Edward Sanderson, H C. Sorby, F.R.S.; and the Rev. J. B Paton, M.A.

The general objects of the school have been already fully placed before the public. The conditions of admission are to be such as render it open to all classes and denominations, and it is expected to be ultimately self-supporting. This, however, cannot of course be the case until it has been working for some time; and it is therefore necessary to raise funds to cover the expenses until it is so. It is proposed in the first instance to raise funds to carry on the school for three years. It is calculated that the amount required will be, for the first year, 500*l*., and for each succeeding year, 400*l*. Of this about 300*l*. a year will be required for salaries. It is proposed to raise this fund by subscription, in the nature of a Guarantee Fund to be reduced by the fees paid by the students. A sub-committee, consisting of Messrs. Baker, Hambly, Paton, and Sorby, has been appointed to undertake the collection of the necessary funds, which, for such an object will, we doubt not, be liberally forthcoming.

SOUTH WALES INSTITUTE OF ENGINEERS.—The fifth annual general meeting of this Institute was held at the Royal Institution, Swansea, on the 12th and 13th of September, Mr. W. Adams, of Ebbw Vale, Aberdare, the President of the year, being in the chair. The following gentlemen were elected as officers for the ensuing year:—*President*, Mr. Thomas Evans, H.M. Inspector of Mines; *Vice-Presidents*, Messrs. W. Adams and Menelaus; *Council*, Messrs. G. Martin, Grenwell, F. Levick, jun., Rhys H. Rhys, David Roberts, J. Cox, and Bedlington Kirkhouse; *Treasurer*, Mr. Brigden; *Secretary*, Mr. Edward Williams. The new members elected were:—Messrs. T. Williams, M.D., Thomas Eaton, W. S. Dorman, and G. Brown. Mr. J. Brown was received as a graduate.

There being no discussion on the papers postponed from the last meeting, the following new papers were read:—

1. On the Selection and Treatment of Coals for the Blast-furnace and Cupola, by Mr. J. Cox.

2. On Puddled Steel, by Mr. George Parry.

3. Mining in the county of Leitrim, by Mr. H. T. James.

4. The Application of Machinery to Cutting Coal, by Mr. C. H. Waring, Neath.

5. On the Ventilation of Mines, by Mr. Hale.

An interesting discussion took place on Mr. Cox's paper, in which Mr. Geo. Parry, of Ebbw Vale, Mr. Walter Child, Mr. Menelaus, and the President took a part. The discussion on Mr. George Parry's and Mr. H. T. James's papers was postponed until the next meeting.

On Mr. Waring's paper an important discussion also took place, in which Messrs. Menelaus, W. S. Clarke, Lionel Brough, Thomas Evans, and Baggott took part. Mr. Menelaus firmly believed that they would some day or other have a coal-cutting machine; but he did not think that Mr. Waring had got hold of exactly the right plan. Working underground was getting every day more objected to, and unless they did something in the matter he believed coal would get very dear. Mr. Brough said this was an old subject, and he feared it would be fifty years yet before they had a practical coal-cutting machine, although Mr. Menelaus took a more hopeful view. Mr. Baggott suggested that a premium of 500*l*. should be offered for a coal-cutting machine applicable to the work; and the paper was ordered to be printed with a view to further discussion.

The discussion of Mr. Hale's paper was also postponed.

M. E. Fremy on the Production of Steel.—At the sitting of the French Academy of Sciences, on the 18th August, a memoir was presented on this subject by M. Frémy, well known for his researches on the composition of steel.

The author commenced by observing that steel is destined to play a far more important part in industry than hitherto. It is already employed for rails, axles, tires, piston-rods, and shafting; military men are thinking of producing cast-steel guns, and men-of-war will soon replace their heavy iron plating by a light, elastic, and tough plating of steel. It is evident that those nations who do not strive to keep up with the march of science, will very soon be left in a position of inferiority.

France possesses abundance of iron ores of good quality, but fuel is dear and transport still costly; hence the metallurgical methods to be sought for must be such as will reduce the cost of fuel to a minimum, so that good French ores shall be the principle article of expenditure.

The author goes on to enumerate the distinctive qualities of cast-iron, malleable iron, and steel, remarking that steel has the good properties of the two other varieties without their objectionable features. Hence cast-steel is the best material for any new applications of iron, and the question is how it shall be obtained in considerable masses. The Yorkshire method gives excellent steel, but in this proceeding it has hitherto only been found practicable to fuse in crucibles containing not more than 20 kilogrammes (44 pounds) of steel. Reverberatory furnaces have so far given no results on a sufficient scale. Again, this method requires malleable iron specially adapted for the purpose, and very costly, and in addition a large quantity of fuel, equal to six or seven times the weight of the steel obtained. On this system, therefore, France could not successfully compete with England, for to her economy of fuel is of great importance. The author had endeavoured to work with this object in view, and to discover a method in which fuel shall be little required; and he states that he has completely succeeded in doing so, but excuses himself for not going into details, as he could not do so without unveiling what he had only learnt in confidence. He observed, however, that in following out the process, strict chemical examination of the cast-iron is necessary. Each variety requires a special

study in order to ascertain what ingredients it possesses and what it wants. Chemical analysis is, therefore, the only true guide. He concluded by anticipating a great revolution in the metallurgy of iron from the facts here indicated, and it will be one which will place France in a more advantageous position than heretofore.

Mining, Quarrying, and Metallurgical Review.

CORNWALL AND DEVON.

THE firmness in the prices of tin and copper have had an excellent effect on the tone of mining in these counties. The standard of copper ore has, within about two months (including the sale of the 25th September) advanced nearly 7*l.*; and although, up to the time we write there has been no official advance in the standard of black-tin, most of the smelting houses have recently been paying prices beyond the quoted standard, and an official advance is daily expected.

The great feature of the month in mining in these counties is, of course, *East Caradon*, where the lode has been cut in the 70, as rich as could have been anticipated by the most sanguine expectations. This undoubtedly makes East Caradon the best copper mine in the county; but it is rather remarkable that the shares have not advanced in the ratio expected, and have, indeed, receded some pounds since the lode was cut. Of course, in the opinion of all reasonable men, any possible discovery at the 70 was "discounted" by the price the shares reached before the lode was intersected at that level; but still there seemed to be a general opinion that shares would still go higher, and that they have not done so is creditable to the good sense of mining speculators. This mine is now selling for upwards of 300,000*l.*, so that for purchasers to get back their principal with 5 per cent. interest, it must divide within the next few years, at least 500,00*l.* in profits. In considering whether or not the price of the mine should advance beyond its present rate, we have to consider the probabilities of its paying more that half a million within that period—and that only valuing money at 5 per cent., and leaving out of the question those often untoward mining contingencies to which the finest concerns are liable. We are of course aware that there are some people who believe that in a good mine shares cannot go too dear, and who brand any one who suggests moderation, as "an enemy to mining." East Caradon has undoubtedly good prospects from the north lodes, but when these are cut rich, it will be quite time enough for shares to advance on the strength of them, beyond the 300,000*l.* and odd, for which it is at present selling. This mine is a splendid property and a splendid success; it has made the fortunes of all connected with it, and done infinite good to Cornish mining; and we have now only to hope that the good name of the mine, and mining enterprise generally in this county, may not be compromised by pushing the shares to such rates as to leave but little chance of profit to new comers-in. This has occurred in more than one of our best Cornish concerns, where the public have bought at such prices, that the mines—although thoroughly good ones—have never been able to pay back half the money sunk. Hence discontent, and the bad reputation of mining.

A boundary dispute of rather a confused character has arisen between two mines in Gwinear—*Wheal Unity Consols* and *Rosewarne Consols*—which threatens to end in litigation. The value of the matter in dispute is at present *nil*, for it merely comprises a trial shaft on a promising lode; and the nature of the dispute itself, is a confusion and ambiguity in the

description of the premises demised, in some respects similar to the famous dispute between South Frances and West Basset. It would be a waste of space to enter minutely into the matter, but we may say that it arises from an unfortunate practice—long since abandoned in all good offices—of giving a verbal description in the body of the lease of the premises demised, and also referring to a map as more particularly showing the premises. The chances are that in a large proportion of any given number of cases, the written description and the map will be found on strict examination to disagree in some minute points; and then the question arises which is the best authority? The written description, if clear, will probably carry the day; but a discrepancy of the kind is most unsatisfactory, for a mine adventurer certainly, as a rule, looks more to the map on the lease for the limits of his sett than to a description which he finds it difficult to read, and more difficult to understand. Conveyancers experienced in matters of the kind, now make it an invariable rule, either to give a full written description of the premises, and no plan; or to give a plan to which they refer as the sole authority, omitting any particular written description.

There is nothing new in *Ludcott*, and the furious speculation of which it has been recently the object, having now ceased, it may be left to go its way steadily. The mine is fairly worked, so that the problem as to how far silver can be made profitable in Cornwall will, no doubt, receive some solution within the next year. If it should turn out, contrary to the experience of the county, that a regular and permanent deposit of silver is found, and that it can be worked for any time to a profit, it will be a new feature in Cornish mining, and will cause greater attention than has been hitherto given to be paid to argentiferous deposits on cross-courses.

Two new companies are announced in Cornwall—*New Wheal Fortune*, and the *Royalton Tin* Mining Company. The former is started under respectable auspices for working the ground in the parish of Sithney, hitherto known as New Wheal Vor and East Wheal Metal. The sett is very extensive, and contains the eastern continuation of the Wheal Vor and Wheal Metal lodes, on the same parallel as Prospidnick. It is said that Mr. Robinson, the purser, and Captain Joseph Vivian, the manager, of Great Fortune, will occupy the same positions in this mine. The Royalton tin mine is in the less known district of St. Columb; and is brought out with reports from Mr. J. H. Hitchens, formerly connected with Devon Great Consols.

Among young mines in the western part of the county, we know of none more promising than *Gurlyn*, where a good discovery has been made. The position of the mine is excellent, being in virgin ground on the same run as the old mines of Enys Wheal Virgin, on the west, and Godolphin, on the east, both of which have made fine profits.

The annual meeting of the Royal Cornwall Polytechnic Society, commenced on Monday, the 22nd, at Falmouth. The general show was good; but the mechanical department was in inferior to former years, which to some extent is to be attributed to the competition of the International Exhibition. The only objects exhibited bearing directly or indirectly on Mining, were some Models of Crystals and "Nets," by Mr. Jordan, of the Mining Record Office, Jermyn Street; and an Improved Miner's Theodolite and Dial, by Mr. Wilton, of St. Day, to both of which medals were awarded. Two highly interesting lectures on Geological Subjects, were delivered by Mr. Pengelly, of Torquay. In one of these, he announced the important fact, that a scale of the *Phyllolepis* (a true Old Red Sandstone fish) had been found in the *Pleurodictyum* beds of the Devonian series, at Torquay, associated with marine corals. Besides affording the long sought for link between the Devonian and Old Red Sandstone rocks, this discovery proves that the former are *higher* than the Red Sandstones of Scotland, and also that the *Phyllolepis* was a marine and not a fresh-water fish.

WALES AND THE BORDERS.

South Wales.—The iron trade has shown a good deal of activity during the past month. Some good orders for the best description of bars and rails, have been received from the continental states, and in the middle of the month there were some heavy consignments of iron to Russian ports. This has had an invigorating effect, and the interior of the district presents a far more cheering and animated aspect than a few months ago. The price of iron is still low compared with what it was in former years, but upon comparing the present rate with the rates at the corresponding period of last year, it will be seen that the apparently small advance is really rather an important one. Last year, rails sold at the works for *5l.* *2s.* *6d.*, and now they are *5l.* *12s.* *6d.* Merchant bars and other descriptions of iron, have advanced in nearly similar proportions, and the aspect of things generally, gives encouragement as regards the future. The Abernant and Llwydcoed works, Aberdare, have been going on steadily, every branch being well employed. The Ebbw Vale Company are preparing to light an additional furnace at Ebbw Vale, and some extensive alterations are about to be made in the works, in order that the benefits of recent improvements in iron-making may be realised as far as possible. It has been determined to build several more puddling furnaces at Aberyschan, and if, as is generally expected, another furnace will soon be lighted, hundreds of additional hands will be employed, and Aberyschan will soon wear a thriving and prosperous aspect. Messrs. Sutton and Bennett are also about to erect two blast furnaces in the neighbour of Neath. All this indicates that capitalists are sanguine as to the future of the iron trade; and judging from the present tendency of the market, there is every reason to believe that the expectations formed will be realized.

It is rumoured that the Mwndy Iron Company likewise contemplate the erection of two furnaces, on their property near Llantrissant; a very proper determination on their part, when we consider that a large quantity of ore which has been raised, cannot be sold, but yet can be utilised and made a source of profit in connection with the furnaces.

The coal trade is firmer than has been the case for some time, although it has not shown so much activity as the iron trade; still a brisker demand exists, and coal-masters are confident of better prices in a short time.

The export trade has been very active, more especially at Cardiff, which could hardly be supplied with coal to meet the demand of the ships in port. Newport, Swansea and other ports, have also been well supplied with shipping, and a good deal of coal was exported from each. Cardiff maintains the lead for exports, both of coal and iron. During the past month, no less than 137,073 tons of coal, 15,620 tons of iron, 2,782 tons patent fuel, and 52 tons of coke, were exported, which is largely in excess of the corresponding month of either 1861 or 1860. The returns for August, 1861. were 106,676 tons of coal, 17,528 tons of iron; and for August, 1860, 103,458 tons of coal, and 14,821 tons of iron. The total quantities of coal and iron exported during the first eight months of the present year, were 871,524 tons of coal, and 129,088 tons of iron, considerably more than the corresponding period of any previous year, notwithstanding the depression caused by the American war.

The trade of Neath is almost exclusively confined to the European and coasting, the depth of water not allowing the entrance of any large class of shipping. By the statistical returns, a good stroke of business seems to have been done in both branches during the past month. The number of ships entering the harbour was 291, with an aggregate register tonnage of 20,935, the burden tonnage being 32,371. The imports were—5,038 tons of copper, 1,310 tons of pig-iron, 4,666 tons of iron ore, 403 tons of pit and cord wood, and 540 tons of timber; whilst the exports amounted to 28,359

tons of coal, culm, and coke, 63 tons copper, 1,166 tons bar-iron, and 219 tons tin-plates. These returns are a satisfactory increase as compared with the corresponding month of 1861.

The following are the statistics of the trade of Swansea:—

The total number of vessels entering the port during the month of August, was 549, with an aggregate registered tonnage of 55,658 tons, and the shipping rates received, amounted to 1,346*l*. 16*s*. 2*d*. During the month of August, 1861, 447 vessels, with an aggregate registered tonnage of 47,633 tons, entered the port, the shipping rates received being 1,181*l*. 3*s*. 8*d*., being an increase in favour of August, 1862, of 102 ships, 8,023 tons, and 162*l*. 12*s*. 6*d*. The increase during the past month has been in the coasting and European branches, there being, in fact, a slight falling off in the foreign trade of the port.

The harbour trustees of this port, have just published official statistics of its trade, for the first eight months of the present year, as compared with the corresponding period of 1861, and the aggregate is decidedly in favour of 1862. The number of ships which entered the port for the first eight months of the present year, was 3,979, with an aggregate registered tonnage of 439,385 tons, and the shipping rate received were 10,598*l*. 15*s*. 5*d*. For the first eight months of 1861, the number of vessels was 3,999, with an aggregate registered tonnage of 428,454, and the shipping rates were 9,152*l*. 17*s*. 1*d*., leaving a decrease of twenty ships, but an increase of 11,931 registered tons, and of 745*l*. 18*s*. 3½*d*. shipping rates. The exports are not published, but have been estimated, at between 50,000 and 60,000 tons, exported during the month of August. The arrivals at Swansea during the month, include—1,612 tons of copper ore and regulus, 600 tons of unwrought copper, and 480 tons of silver ore.

By the Custom House reports for the month of August, the South Wales ports stand in an enviable position compared with the northern coal ports, as will be seen by the following statistics. Exports of coal (to foreign ports) during August, 1862, and the increase or decrease as compared with the corresponding month of last year:—

Newcastle..	tons	179,505	....	18,107	tons decrease.
Blyth	"	9,188	....	3,358	" "
Amble	"	4,715	....	1,135	" "
Sunderland	"	104,280	....	2,014	" increase.
Hartlepool	"	69,997	....	11,793	" "
Cardiff	"	136,123	....	28,452	" "
Newport	"	20,262	....	8,745	" "
Swansea	"	36,856	....	5,534	" "
Llanelly	"	10,421	...	1,004	" "

Extensive alterations have been effected in the winding shaft of the Black Vein Colliery, Risca. Since the great explosion, several improvements have been made in the colliery, and when the new furnace is completed, the pit will be one of the best ventilated in the neighbourhood, and will possess facilities which will enable the company to considerably increase their shipments.

In metallic mining in South Wales, a new company is about being started to work *Pantygleian and Merlin Hill Lead Mines*, situated about four miles east of Carmarthen.

MERIONETHSHIRE.—Another gold company is about being started in this county for re-working the old Caegwian Mine, which is situated about 4½ miles eastward of Barmouth, in the neighbourhood of Clogau. The proposed capital is 100,000*l*., in shares of 2*l*. 10*s*. each, and the company is to be called the *St. David's Gold Mining Company*.

DENBIGHSHIRE.—Lead mining in the Minera district continues to be prosecuted with vigour and success. *Minera*, as will be seen by our Lead

Ore Sales, is now yielding 600 tons of ore per month,—by far the greatest quantity returned by any lead mine in the United Kingdom. This mine is under the management of Mr. John Darlington, Mr. John Taylor, junr. (of the firm of Messrs. John Taylor and Sons), being the consulting engineer. Adjoining this, on the south, is the *Park Mine*, in hands of a rich private local company. The vein, which is parallel to that of Minera, about half a mile to the south, has yielded, above the water level, and on a small scale of working, 18,000 tons of lead ore, which have left a profit of 162,000*l.* Since then the works have been prosecuted on a small scale under the water level, below which a splendid course of ore of great length has gone down. In order, however, to work this with profit, it has become necessary either to erect extensive and costly pumping machinery, or to arrange to continue the driving of the Minera shallow day level, which was commenced many years ago, and which will come in 230 yards deep in the Park Mine at the upper or eastern shaft. In consequence of lengthened discussions between the two companies, and the lords, as to the terms on which the level was to be driven, the effectual working of the Park Mine has remained in abeyance for some time. Recently, however, the matter has been finally settled, and within the last fortnight a contract has been let to drive this Minera shallow day level to intersect the Park Vein, for the sum of 2,106*l.*, which amount is to include materials. This day level, which is driven very large, has, it is estimated, to be extended about 300 yards further to cut the Park Vein, on which it will come in 230 yards deep at the upper or eastern shaft. When this is accomplished Park will, beyond all doubt, make a splendid mine: it is only a question of time and capital. There are three shafts at Park Mine: the Western shaft, down 350 yards; the Middle shaft, down 550 yards; and the Upper or Eastern Shaft, which is a new one, down at present 145 yards from the surface, the last 20 yards of which has been in the limestone. At this eastern shaft the Park Vein forms a junction with the Ragman Vein, which passes thence through the western part of Minera sett to the ground called Central Minera. These veins are now being cross-cut to at the bottom of the shaft, and as the ground is highly mineralized there is reason to expect that a good course of ore may be cut when they are intersected.

At *South Minera*, which is still further south, and which is also worked by a highly respectable company, the engine-pit is down 105 yards, and as it has reached the bearing measures a cross-cut will be driven to the vein in a month or so. At *South Pool Park* adjoining, with strong veins and the regular productive measures, some ore has been met with at the outcrop; but the workings here are on a small scale, and not much ground has yet been opened. Park Mine and South Minera are under the superintendence of Mr. Edward Williams, of Wrexham; and the management of such respectable concerns forms a refreshing contrast with certain schemes brought out by London sharebrokers, and puffed to the skies, but which in the result have brought no small discredit on the district.

GLOUCESTERSHIRE.—Among the exports from Bristol during the month have been: 9,000 tons of railway bar iron, and 2,000 tons of coal. Among the imports were: 475 tons of pig-iron; 2,622 tons of pig-lead from Seville; 1,111 tons of sulphur ore from Arklow; 180 tons from Pomaron; and 235 tons from Sicata. The imports into Gloucester comprise 1,052 tons of coal. Among the exports were: 450 tons of iron, and 1,062 tons of coal. The general trade has been satisfactory.

MIDLAND COUNTIES.

DERBYSHIRE.—A more cheerful feeling prevails the iron trade, but not much more activity than has characterized it for some time past. The orders for all descriptions of iron are more numerous, and there has been a

demand for articles required for the war, from America. There is great reluctance, however, manifested in receiving private orders not accompanied by a remittance, owing to the uncertainty prevailing as to payment. There is a better inquiry for plates and rails, the latter being required more for the renewal of permanent way than for export, and generally the inquiries at present are for railway iron work. Orders from the Continent are more numerous, and advices speak favourably of the future prospects of trade in general. The steel trade at Sheffield is much more active than it was, and an increase has taken place in the demand for all kinds of cutlery goods. It may be observed that in the seven months ending July 31, 1862, the exports of steel to America amounted to 278,155*l.*, whilst in the corresponding period of 1861 it only reached 182,589*l.*

The coal trade continues to manifest signs of gradual improvement. Merchants are laying in stocks for the winter trade; and, as prices and freights are low, the present is an unusually favourable opportunity to take advantage of the low prices of the article. The Midland Railway Company are pushing forward the works on the new line from Rowsley to Buxton, when a fine tract of mineral country will be opened out, and from the preparations going on it is likely that steps will be taken during the next year to develope its great mineral wealth. On the Erewash Valley line the mineral traffic is increasing, and were it not for the depression in the cotton districts the consumption would be at least one-third more.

In metallic mines, progress has been made in the Derbyshire lead mines, the weather having been favourable for mining operations. Eyam mine is said to be looking well. North Derbyshire has not finished sinking the ground having been very hard.

Staffordshire and Warwickshire.—The more favourable accounts given of the state of the iron trade in this district within the last month are fully borne out by the experience of the trade; and at the present moment there is an indisposition to accept orders at some of the works, except at an advance. Opinions differ as to the permanence of the present demand, but there is no doubt of its being at present very good. As yet prices are low, but underselling for common bars is a good deal diminishing. Pig-iron is fully 2*s.* 6*d* per ton dearer than at the commencement of the quarter. That advance has been paid to a rather large extent, and some makers are asking 5*s.* more, which, however, is not conceded. Best native hot-blast pigs are at 3*l.* 5*s.* to 3*l.* 7*s.* 6*d.*, and inferior sorts range from 2*l.* 12*s.* 6*d.* for cinder pigs, upwards. Hematite forge pigs are now quoted 3*l.* 7*s.* 6*d.*, although large buyers may, perhaps, obtain lots at a reduction on that price. In considering the extent which any immediate advance can reach, it must be remembered that there are a great number of blast-furnaces only awaiting a slight advance in price which may be likely to be permanent, to be blown in, and thus help to check the rise in price by increasing the supply. American orders extend to most descriptions of manufactured iron, especially boat-plates, for which there is a large demand. The makers of armour-plates are largely increasing their power of production in order to keep up with the demand. The rapid and continuous increase in the demand for iron for France also helps to account for the improved state of the trade; Spain is also augmenting her consumption to a very important degree. Railway plant is in better request, and a leading firm in the East Worcestershire district has obtained a very valuable order for every description of iron rolling stock. There is reason to conclude that this demand will for some time be perceptible, and that there will be manifest activity at the leading houses where such iron is manufactured, the demand on account of foreign railways being, for the autumn season, better than usual. The leading demand still runs on sheets and plates, but general merchant iron is in better request now than it has been since midsummer, and the demand is increasing. The houses that are

engaged on the Canadian orders in particular are very busy, making great efforts to have their orders out of hand before the St. Lawrence is frozen over—the alternative route through the United States being at present beset with so many difficulties.

For ironstone of best quality, the produce of this district, the demand is better than is often the case at this time of the year.

The coal trade is decidedly brisk. The colliery proprietors are experiencing a demand corresponding with the demand for iron; and they are at present refusing to enter into fresh contracts at less than 6*d.* and 9*d.* per ton in advance of last prices.

NORTHERN COUNTIES.

Northumberland and Durham.—General trade in these counties is much the same as it has been for some months, and there is little change to report one way or the other. The iron trade maintains its activity, and seems likely to preserve it for some time to come; several of the large firms having received some good orders lately. Since the opening of the new railway to Rosedale there has been a gradually increasing demand for the iron ore of that district, and at present we hear that the supply is not equal to the want. This ore is found exceedingly useful for mixing with the Cleveland ironstone, and it is coming into great favour further north. The furnaces in Cleveland are doing well, and if the recent advance in Scotch pig metal had been supported four or five fresh furnaces would have been blown in. The iron works keep busy, and employment is given to a large number of skilled mechanics and artizans. A return of the state of the blast furnaces in South Durham and Cleveland, on the 1st of September, shows a very encouraging state of affairs. There are not only more furnaces in existence than was the case at the same time last year, but there is still a larger proportion of them in blast, as the following figures will show:—

1862	Furnaces in blast,	55;	out, 24;	........Total 79
1861	„ „	48	„ 28	„ 76
1860	„ „	52	„ 22	„ 74
1859	„ „	52	„ 15	„ 67
1858	„ „	51	„ 14	„ 65

The household coal trade has slightly improved since our last, stimulated partly, no doubt, by the healthier tone of the London market, and the approach of winter. In coking and manufacturing sorts there is no noticeable change, but hopes are entertained that they will get a trifle better as the year draws to a termination. The export coal trade for the last month from the north-eastern ports shows, on the whole, a slight falling off as compared with the corresponding month of last year, the total exports having been 397,521 tons, against 399,393 tons in August last year. At the principal port there is a considerable falling off—that is, at Newcastle, where the exports were 179,505 tons, against 197,612 tons. This falling off is only to be accounted for by the want of accommodation in the Tyne for the larger class of vessels. This deficiency is about to be removed; the depth on the bar has reached 13 feet at low water, and 28 feet at best tides, and is still being increased, so that all that is now required to accommodate the largest vessels is the construction of the dock at Low Lights. A plan has been devised by Mr. Jones, the engineer of the Blyth and Tyne Railway, by which this dock can be constructed at a comparatively small outlay in the first instance, to be enlarged as required at a future time. This plan appears to be a judicious one, and it meets with favour, so that there is little doubt the Tyne will shortly be capable of accommodating vessels of every class, and a great impulse will, by this

means, be given to the export steam coal trade, as the great steam coal district lies immediately contiguous to the Tyne and the site of the proposed docks.

The timber trade seems to be in a healthy condition, and chemicals are bringing a good price as stocks continue low, and exportation has been going on pretty briskly.

The shipping trade, both on the Tyne and the Wear, has been moderately active, though without excitement. Among the exports from the Tyne during the month have been: 204,711 tons of coal; 66,579 cwt. of iron; 9,723 tons of coke; and 31,551 cwt. of alkali. Among the imports: Cargoes of pyrites and manganese ore from Pomaron, Huelva, Laja, Dordt, Antwerp, Rotterdam, &c.; 188 tons of iron ore from Pomaron; cargoes of bars of lead from Carthagena; cargoes of iron ore from Gothenburg; 2,372 bars of lead from Adra, and 4,190 bars from Carrucha.

The Lanchester Valley branch of the North-Eastern Railway connecting Durham with the Consett Ironworks and district was formally opened on the 1st of September. The line passes up the valley of the Brownie by Lanchester to the important works at Consett. The line will add considerably to the value of those works, and contribute much to their success, as it gives much increased facilities for the conveyance of finished iron from the works, and also opens up a new field for the supply of coal and coke for consumption at the works.

The Miners' Permanent Relief Fund for the counties of Northumberland and Durham continues to make progress. A successful meeting was held at Houghton-le-Spring, on the Wear, on Saturday, when the subject was discussed—about 1,000 persons attended. It appears that the society now numbers 7,000 members, and the numbers are rapidly increasing. The fund may be considered an established fact, all that is required to ensure its success being firmness and unanimity on the part of the men. The payments are comparatively very small per man weekly, and the advantages to be derived very great. The labours of the agent appointed, Mr. J. Howie; have been attended with much success, large numbers of the men at each colliery he has visited having joined the society, in some cases the whole of the men employed. The coalowners have not yet formally countenanced the movement, but there is little doubt that they will do so when the proper times arrives.

LANCASHIRE.—From Messrs. J. and J. Platt's Coal Circular for September we find that the quantity of *coal*, *cannel*, *coke*, and *patent fuel shipped from Liverpool* to foreign and colonial ports during the month of August was 67,629 tons, against 62,523 tons during the corresponding month of last year.—Showing an *increase* of 5,106 tons. The total quantity shipped during the eight months ending August was 408,580 tons, against 440,504 tons during the same period last year - *decrease* of 31,924 tons. The following are the particulars of the quantity of each shipped to each of the following ports:—

Coal: Aden, 1,356; Alexandria, 301; Alicante, 251; Bahia, 503; Berbice, 260; Bilboa, 344; Bombay, 3,359; Bordeaux, 680; Boston, 123; Buenos Ayres, 56; Calcutta, 310; Callao, 1,028; Candia, 204; Cape Town, 175; Civita Vecchia, 175; Colon, 40; Curaçoa, 270; Demerara, 484; Denia, 55; Falkland Islands, 40; Fernando Po, 733; Galatz, 285; Genoa, 494; Gibraltar, 822; Harbor Grace, 75; Hong Kong, 2,236; Jamaica, 10; King George's Sound, 1,263; Labrador, 20; Lisbon, 20; Madeira, 1,250; Malta, 1,051; Malaga, 240; Maracaibo, 21; Martinique, 1,770; Melbourne, 296; Miramichi, 20; Monte Video, 415; Montreal, 1,073; Nantes, 159; New York, 4,717; Nickerie, 201; Oporto, 800; Palma, 266; Para, 310; Perlusola, 170; Pernambuco, 180; Point de Galle, 4,880; Puerto Cabello, 40; Quebec, 3,252; Rio Grande, 75; Rio de Janeiro, 590; Salonica, 91; Santos, 40; Sedashegur, 300; Shanghae, 1,600; Singapore, 1,843; St.

John's, N.B., 1,458; St. John's, N.F., 366; St. Nazaire, 518; St. Petersburg, 98; St. Thomas, 777; Syra, 454; Valparaiso, 1,347; Vera Cruz, 555; Victoria, V.I., 30.—*Cannel:* Bahia, 206; Berbice, 20; Boston, 126; Buenos Ayres, 463; Cardenas, 282; Cronstadt, 785; Gibraltar, 111; New York, 14,229; Palma, 106; Rio de Janeiro, 2,773; San Francisco, 171; Shanghae, 30; St. Petersburg, 125; Victoria, V.I., 66.—*Coke*; Bombay, 303; Calcutta, 396; Colon, 10; Constantinople, 71; Lima, 10; Monte Video, 31; Valparaiso, 70.—Totals: Coal, 47,245; cannel, 19,493; coke, 891.

The exports *coastwise* during August were 10,316 tons, against 8,294 tons during the corresponding month last year—showing an *increase* of 2,022 tons. The total shipped coastwise during the eight months ending August was 49,490, against 55,858 tons during the same period last year—showing a *decrease* of 3,368 tons. The following are the particulars of the quantity shipped to each of the following ports:—

Aberayon, 6; Amlwch, 287; ditto, coke, 12; Arklow, 65; Askeaton, 150; Ballina, 138; Ballyshannon, 245; Bangor, 25; Barmouth, 357; Beaumaris, 20; Belfast, 627; Bodorgan, 80; Bray, 90; Bristol, 60; Bulloch, 120; Campbeltown, 23; Carnarvon, 230; Clonakilty, 120; Cork, 550; Conway, 104; ditto, coke, 2; ditto, slack, 8; Courtown, 275; Dingle, 120; Douglas, 45; Dublin, 3,336; Dundalk, 192; Foyne, 154; Holyhead, 182; Kilrush, 127; Kingstown, 416; Limerick, 493; Londonderry, 370; Menai Straits, 84; Mochras, 20; Nevin, 80; New Quay, 64; Newry, 362; Dinorwic, 124; Port Madoc, 230; Port Rush, 105; Portinllaen, 23; Pwllheli, 89; ditto, coke, 4; Ramsey, 62; Red Wharf, 40.—Total, 10,316.

The threatened strike in Wigan has been avoided by an amicable settlement of the dispute between the coal proprietors of the district and their workmen, who have returned to work.

SCOTLAND.

There has been a large amount of speculation in the Scotch pig-iron market during the month, chiefly attributable to Liverpool speculators. There has been some diminution in the number of furnaces in blast, owing to the strike; but now that it for the present is settled by the colliers receiving the advance demanded, the furnaces are again in operation, making the total now in blast 118, the same as in July. The home trade has rather improved than otherwise; and while there is no great activity manifest, yet, on the whole, it is as satisfactory as could be expected under existing circumstances. Shipments have continued on a fair scale averaging 10,752 tons per week against 11,853 tons in the corresponding nine weeks of last year. The returns for last month, however, show an increase of 1,836 tons as compared with same month of 1861. They were in

August, 1862,

Foreign	24,355	45,770, against
Coastwise	21,415	

August, 1861,

Foreign	21,348	43,934 tons.
Coastwise	22,586	

The Glasgow coal trade continues much the same. The strike at Dyke Hill colliery has terminated in the men returning to work at the advance they demanded.

THE CONTINENT.

FRANCE.—Transactions in copper have been of no great importance at Paris; nevertheless, prices have been maintained, English having been quoted at 93*l*., Chili, at 88*l*. to 88*l*. 10*s*., and Lake Superior at 104*l*. to 105*l*, per ton. There have been few transactions worth mentioning at Havre, but a lot of 5 tons of Lake Superior, Cliff mark, changed hands at 97*l*. At Marseilles, 8 tons of old bronze, and a lot of 5 tons of red Toka copper, have been dealt in at former quotations.

In the Haute-Marne district pig has been without demand, and might have been purchased at 5*l*. 4*s*.; iron has been tolerably firm at 9*l*. 12*s*. to 10*l*. It is probable that the rolling-works of the Sambre, at Maubeuge, belonging to a Belgian Company, will shortly be again put into activity. The works could, it is urged, effect the production of iron under very favourable conditions, as they could draw pig from Belgium on paying a duty of 1*l*. per ton. As the manufacture of 10 tons of iron would require about 13 tons of pig, a ton of iron, the product of Belgian pig, would, on leaving the works, have paid Customs' duties to the extent of 1*l*. 6*s*., while Belgian irons, on entering France, must pay 2*l*. 16*s*. per ton. The metallurgical establishments of the Maubeuge-Hautmont group possess, then, considerable advantages, the price of combustible being almost the same as in Belgium. A French establishment has just obtained, by public tenders, a contract for 9,000 tons of pipes, required in connection with the Dhuis water. Hematite pig continues to be much sought after in France, especially by the Imperial Marine, for the manufacture of cylinders.

It appears, from official returns just made up, that the production of the works of the Haute-Marne district amounted last year to 66,000 tons of rough pig, 17,500 tons of cast pig, 46,000 tons of rolled iron, 6,000 tons of hammered iron, 1,860 tons of points, and 1,500 tons of plates. Compared with the returns of former years, these figures indicate the following changes:—The blast furnaces producing refined pig have turned out about 15,000 tons less, while the forges increased their production to the extent of some 7,000 tons. The works of the Haute-Marne group were obliged, then, to seek for a considerable quantity of their pig abroad.

BELGIUM.—It is stated that the price of pig is firmly sustained, the Gillain-Lobest Company having, for instance, just concluded a contract for 10,000 tons of refined pig, at 3*l*. 2*s*. per ton. The blast furnaces in Belgium, which have hitherto produced pig with wood, find themselves, under present circumstances, in a difficult position. Of twenty-six of this class of furnaces which exist in the province of Namur, five only have been in activity during the past year. The Namur Chamber of Commerce has just issued its annual report, and it appears that the total amount of rough pig produced in the province last year, either with coal or wood, was 21,632 tons, of a gross value of 78,424*l*. A slight revival of activity occurred in forging with wood, but it referred exclusively to the manufacture of iron intended for arms and heavy rails. The production of cast pig amounted to 3,236 tons, of the value of 24,108*l*. The iron-making establishments produced 12,921 tons of forged iron, of the value of 100,663*l*.; and 519 tons of wrought-iron, of the value of 8,182*l*. It is confidently contended that in a few years siderurgical operations carried on with wood will be only a matter of history, as this industry is one of those decaying branches of human enterprise which possess no elements of vitality. The grand Duchy of Luxembourg is sending increasing quantities of ironstone into Belgium, while France continues to import Belgian ores. In the first seven months of 1862, the importation of iron ores into Belgium amounted to 61,000 tons, while 124,000 tons were exported. When the Guillaume Luxembourg Railway is completed to Liege, and when the blast furnaces

of the Meuse can receive, on cheap terms, the minettes of Esch, Rumelange, &c., the working of these mines will acquire a much greater extension, of which they will readily admit, as the bearings are spread over a vast extent of country. Messrs. Evrard and Co., of Brussels, have just shipped at Antwerp some large plates intended for great iron bridges on the Novotcherkask Railway, in Southern Russia.

Coal Markets.

LONDON.—From the return of the registrar of the London Coal Exchange of the quantity of sea-borne Coal, Culm, and Cinders imported into London during the month of August, we learn that the total quantity was 274,834 tons against 301,505 tons during the corresponding month last year—showing a *decrease* of 26,671 tons. The total quantity imported during the eight months ended August 31st, was 2,207,415 against 2,287,158 during the corresponding period last year—showing a *decrease* of 79,743 tons.

The following are the particulars of the 274,834 tons imported during August:—

Newcastle ..	82,626 tons, in	231	ships	Scotland ..	1,638 tons, in	12	ships
Seaham ..	22,251 „	93	„	Wales ..	14,281 „	31	„
Sunderland.	82,677 „	206	„	Yorkshire ..	3,034 „	31	„
Middlesbro'.	4,000 „	19	„	Small ..	1,123 „	3	„
Hartlepool..	59,847 „	231	„	Cinders ..	1,152 „	8	„
Blyth ..	2,030 „	9	„	Culm ..	175 „	1	„

The quantity of coal imported by railways and canals during the month of August was 132,381 tons against 123,452 tons during the corresponding month last year—showing an *increase* of 8,929 tons.

Towards the end of August the market was dull, in consequence of large arrivals, and but little business was transacted, prices being firmly maintained. The prices for the different kinds were: Best house coal, 16*s*. 6*d*. to 17*s*.; seconds, 14*s*. 6*d*. to 15*s*. 6*d*.; Hartleys, 13*s*. 6*d*. to 14*s*. 9*d*.; manufacturers', 11*s*. 6*d*. to 13*s*. 6*d*. per ton. On the 27th, Hartleys advanced 3*d*. On the 3rd September there was more inquiry for house coal, and a fair business was transacted: Hartleys again advanced 3*d*. On the 5th, the demand for house coal having decidedly increased, many sorts advanced 3*d*., with a still upward tendency: Hartleys were scarce and again advanced from 3*d*. to 6*d*., making a total advance of 9*d*. to 1*s*. within ten days. On the 8th, the demand for house coal increasing, another advance of 3*d*. was established for this sort: Hartleys steady. On the 10th, house coal again advanced 3*d*., and the tone of the market was good. On the 12th there was another advance of 3*d*. in house coal: Hartleys quiet. On the 15th the market for house coal was brisk at another advance of 6*d*., making a total advance of 1*s*. 6*d*. within ten days. On the 17th the large arrival of 105 ships checked the upward movement in prices, but a large business was transacted in house coal at last rates: Hartleys declined 3*d*. On the 22nd there was more inquiry for coals generally, and a fair clearance was effected for all descriptions at last prices. On the 24th, the stock of house coal being low, prices advanced 3*d*. to 6*d*. per ton. On the 26th the market closed steady at the following prices: Best house coal, 17*s*. 9*d*. to 18*s*. 6*d*.; seconds, 15*s*. 9*d*. to 16*s*. 6*d*.: Hartleys, 14*s*. 3*d*. to 15*s*. 9*d*.; manufacturers', 13*s*. to 14*s*. 6*d*.

GENERAL EXPORTS OF COAL.—By the monthly circular of Messrs. Laird,

Liverpool, we learn that the quantities of coal exported during August was 776,455 tons, against 694,059 tons in the corresponding month of 1861—showing an increase of 82,396 tons. The particulars are: From the northern ports, 400,038 tons: Yorkshire, 36,930 tons; Liverpool, 66,582 tons; Severn ports, 212,265 tons; and Scotch, 60,640 tons. The increase was: Northern ports, 343 tons; Yorkshire, 16,702 tons; Liverpool, 7,784 tons; Severn, 47,327; Scotch ports, 10,240 tons. Total exports, January to August, 5,156,392 tons, against 4,934,368 tons in 1861, showing an increase of 222,025 tons,

Contracts for Coal.—The South-Eastern Railway require the supply of from 8,000 to 10,000 tons of steam coal, to be delivered at Folkestone. The Admiralty require a supply of 4,000 tons of South Wales coal for Her Majesty's ships in China, and also a supply for the steam ships at St. Vincent, Cape de Verde; also, 400 tons of South Wales coal, for Valparaiso. The Royal Spanish Naval Board require a supply of coal during two years for St. Jago de Cuba, Clenfueogos, and Batabano.

Metal Markets.

During the month of September the metal market has been characterized by much firmness, a large demand having sprung up which has resulted in the establishment of an advance of quotations in iron, copper, and spelter. As the demand both for consumption and exportation seems to be steadily increasing, and as the market is very strong even at advanced rates, there is every appearance of a further improvement in prices.

Iron.—There has been an advance in almost every description of iron during the past month. In the Scotch pig-iron trade there has been considerable activity, and prices have fluctuated between 55*s.* and 57*s.* 6*d.* for cash. The active speculative demand that existed towards the end of August, when prices were quoted at 57*s.* 3*d.*, subsided towards the first week in September, and quotations fell as low as 55*s.*, but recovered at 55*s.* 6*d.*, at which rate they remained steady to the middle of month. The American news, which was supposed to indicate probabilities of peace, again caused a speculative demand, and orders having also increased prices once more successively advanced to 57*s.* and 57*s.* 6*d.* cash (58*s.* 4½*d.* three months open) at which rate the market closed. Within the last fortnight an extensive *bonâ fide* business has been done, and the market is very satisfactory.

At the end of last month rails were firm at 5*l.* 10*s.* to 5*l.* 15*s.* at the works, with a fair business doing, but the demand increasing they advanced about the middle of the month to 5*l.* 12*s.* 6*d.*, and closed at 6*l.* in Wales, with orders plenty. Merchant bars opened at 5*l.* 7*s.* 6*d.* at the works, and 6*l.* f. o. b. in London, but advanced to 5*l.* 10*s.* and 6*l.* 5*s.*, with orders plenty for immediate delivery: they close at another advance of 5*s.*, being quoted 5*l.* 10*s.* to 5*l.* 15*s.* at the works, 6*l.* 5*s.* to 6*l.* 10*s.* in London. Staffordshire descriptions have been in steady demand all through the month, and closed at an advance of 5*s.* per ton. For Swedish there has been a strong demand, but prices have been kept down by large arrivals. At the beginning of the month Indian specifications advanced 15*s.* from 11*l.* 10*s.* to 12*l.* 5*s.*, and remained for some time firm at from 11*l.* 15*s.* to 12*l.*; but at the close of the month the price fell back to 11*l.* 10*s.* on large arrivals, although a strong demand still continued.

Steel.—The market has been dull throughout the month, but business has been doing in Swedish keg at 15*l.*, at which rate the market has been

tolerably cleared, and stocks being thus reduced sellers are now looking for higher prices.

COPPER.—English opened remarkably firm, nothing being to be had under official prices, and as the month advanced, neither raw nor manufactured were to be obtained under a considerable advance beyond fixed rates: on the 18th, the smelters advanced their quotations 5*l.* on raw, and about 7*l.* 10*s.* on manufactured, which it is determined shall for the future be quoted per ton, instead of per lb. At the close of last month, there were large orders on hand at a trifle under fixed quotations. The firmness of the market caused these to remain unexecuted, and after the first week, there was a general advance; manufactured fetching ½*d.* above official rates, makers holding for 11*d.*, and raw not being obtainable under 3*l.* or 4*l.* above fixed prices. Official prices at the close are, 98*l.* for raw and 105*l.* for manufactured; the demand for the latter at this rate is but moderate, but tough cake has realized 100*l.* in Birmingham, and has still an upward tendency. Burra, which was sold at the beginning of the month at 96*l.*, gradually advanced to 100*l.*, and closes at 101*l.*, which were also the rates quoted for Kapunda. Chili was done at 90*l.*, but advanced to 93*l.* 4*s.* The purchase of Messrs. Gibbs' stock of copper ore by the smelters, is supposed to be one of the causes of the increased firmness in the market.

YELLOW METAL.—There has been a good demand throughout the month for this article, sheets 8¼*d.*, sheathing, 8⅜*d.*, and at the close an advance of ⅛*d.* per lb took place in sympathy with the rise in copper, making present quotations 9½*d.* for sheathing.

TIN.—All through the month, English tin has been in good demand, and firm at fixed rates, and on the 25th, the smelters announced a rise in English of 4*l.* per ton—to 115*l.* for block and ingot, 116*l.* for bars (in barrels), and 120*l.* for refined. In foreign, straits changed hands early in the month at 113*l.* cash, and 113*l.* 10*s.*, with full prompt, but further on, a good business was done at 114*l.* cash, and 114*l.* 10*s.* with full prompt, closing at 115*l.* 10*s.* cash. Banca, quiet, advanced nominally, from 116*l.* 10*s.* The Dutch market was firm at the beginning of the month at 67½f. to 68f., but towards the end of the month improved to 68⅝f., at which 2,000 slabs were done.

TIN PLATES.—All through the month, a large trade has been doing in this article, and manufacturers have continued well supplied with orders, so that little disposition has been shown by them to take orders for forward, as a rise in value is generally looked for. The principal business done has been in coke, and tin and terne plates. Charcoal remained unaltered, but coke is firmer at 1*l.* 2*s.* 6*d.* for IC.

LEAD.—There has been no great demand for this metal throughout the month, but the market has been firm, although there have been no sales of importance. At the close, however, English pig was in more request, and an advance of fully 5*s.* per ton is established on last rates. Ordinary soft, 20*l.* 5*s.*, WB. 21*l.* 5*s.*, Spanish, 19*l.* 10*s.*

SPELTER.—Spelter has been very active during the month, and a most extensive business has been done at prices advanced from 18*l.* to 19*l.* Towards the close of last month, this metal was quoted at 18*l.* in London and Hull; W. H. 18*l.* 10*s.*, and at these rates it held its position pretty well, business to some extent being reported. In the beginning of the month, however, a demand sprung up for export, which led to a slight advance, 18*l.* 2*s.* 6*d.* to 18*l.* 5*s.* being asked for forward delivery. Further on in the month, the demand in London and Hull having steadily increased, and a large business being done, prices gradually advanced, ordinary brands being quoted at 18*l.* 5*s.* to 18*l.* 10*s.*, and W. H. 18*l.* 17*s.* 6*d.* Towards the close of the month a most extensive business was done at from 18*l.* 15*s.* to 19*l.*: W. H. 19*l.* 10*s.* At these rates some thousands of tons are reported to have changed hands within a few days.

Metallic-Ore Markets.

TIN.—The standard for black tin remains nominally unaltered at—

Refined	£102—6
Common	101

but black tin is in demand, and the smelters have frequently given an advance on quoted rates.

COPPER.—At the four Cornish sales we give this month, the number of tons, average produce, quantity of fine copper, average price per ton, and standard, have been as follows:—

Date.	*Tons.*	*Produce.*	*Fine Copper.* Tons. cwt.	*Price per ton.*	*Standard.*
Aug. 28.	2,797	6¾	177 7	£4 19 6	£122 0 0
Sept. 4.	3,624	7	253 4	5 16 0	122 7 0
„ 11.	2,834	6⅛	189 6	5 12 0	124 17 0
„ 18.	6,299	5¾	359 9	4 13 0	129 16 0

At the sale of the 28th, the standard was nearly stationary, prices tending downwards. At the sale of September 4th, the standard advanced 2*l.* 8*s.*, and at that of the 11th it advanced again 1*l.* 5*s.* At the sale of the 18th it was nearly stationary. The total advance during the month has been upwards of 3*l.* 10*s.*—making an advance of about 5*l.* during the two months.

LEAD.—Comparing the lead ore sales this month with those of last month, there has been on an average a slight reduction in price.

London Share Market.

REMEMBERING that September is the holiday month of the year, and is consequently generally slack for business, we must consider that the Mining Market has been fairly active. In certain favourite mines indeed, a large business has been transacted, and to these, more than usually, operations have been confined.

The principal business has been in *East Caradon*, which opened at 47¼–47¾, at which price they remained till the 5th, when they commenced advancing and continued to rise, with a few fluctuations, to 54–55, which price they reached on the 13th; they continued at this quotation with some changes till the 18th, when they commenced declining, and fell to 50 sellers on the 24th, after which they rallied again, and close 51-52: the 70 end is valued at from 80*l.* to 90*l.* per fathom, but a small "horse" is reported in the lode. *Devon Consols* have advanced 30*l.* during the month from 450–460 to 480–490: the mine has considerably improved at Wheal Josiah and Wheal Emma. *Marke Valleys* opened at 10½–10¾, and continued in good request throughout the month at little variation of prices, until towards the close, when they became decidedly weaker, closing at 10–10¼.

East Carn Brea opened at 11¾–12 strong, and steadily advanced until the 5th, when they reached 15, their highest point; on the same day they receded to 14–14½, and on the 8th to 12–12½; after which they recovered to 13¼–13½ on the 11th, at which price they remained steady till the 20th, when they became again weak, dropping to 12–12¼, at which they close: a new north lode has been intersected in the 50 cross-cut north, containing a good lode of ore, and altogether the mine is reported to be looking well. *North Croftys*, which opened at 4¼, have been in good demand all through the early part of the month at a slight advance; but later on were flat for a short time, but advanced between the 20th and 24th to 4¾–5, at which price they close buyers. The lode in the 150 is reported to have improved, and the 170 is worth 20*l*. per fathom. *North Roskear* have been steady at from 25–6 inquired for; they close 24½–25½. A good piece of ore ground, worth 50*l*. per fathom, has been opened on about Pearce's shaft.

Ludcotts opened at 11–11⅛, and shares have been remarkably firm at advanced rates all through the month, stock being uncommonly scarce, and the principal holders being determined to hold by the mine, the bears having largely oversold themselves. No particular advance took place on opening prices till the 9th, when they advanced upwards of 2*l*., from 10⅞–11 to 13–13¼ on the rumour of an improvement. They remained without much alteration for about a week, when they declined to 11¾–12; since then they have again rallied, and during last week have been very firm in consequence of the scarcity of shares, closing at 13¼-13¾. *Wheal Seton* opened at 144–147, and has advanced during the month upwards of 20*l*. per share, closing at 165-168 buyers: the mine is looking very well. *Herodsfoot*, which opened at 42–43, have been very firm during the month, and close at 43–45 strong. *Wendron Consols* have been in demand towards the end of the month, and close at 11 buyers; a considerable improvement has taken place in the Bal Dees part of the mine, where one of the best lodes yet seen has been cut. *Great Wheal Fortunes* have been very steady during the month at about 25–26, they close 25½–26½. No alteration is reported in the mine.

Tincrofts, which opened nominally at 10½–11, were neglected till the end of the month, when they advanced to 11–11½. The sett adjoining this, *Illogan Consols*, which is a very promising concern, also in 6,000 shares, is quoted 7*s*. 6*d*.–10*s*. (5*s*. paid). *Gurlyn*, which opened at 2¾–3, has been in strong demand all the month, but shares difficult to get; it closes 3–3¼. *East Russell* opened at 3¼–3½, and on a brisk demand advanced to 3¾–4; they close flat at 3¼–3½. *Wheal Grylls* opened 23–25, but few transactions have occurred, and they close 24–26. Fisher's lode, below the 30, worth 50*l*. per fathom. *East Rosewarnes* have been steady at 2½–2¾. A few transactions in *Great South Tolgus*, at an advance of from 3¾–4 to 4–4¼: lode in Lyle's shaft worth 70*l*. per fathom.

South Caradon opened at 350–360, and has been in considerable demand during the month, quotations at one time reaching 380–400; they close 370–380. In *North Downs* a fair amount of speculative business has been doing: shares opened at 3¼–3½, and remained

steady within a fraction of that price, closing at 3⅛–3⅜; the lode in 60 west improved to 10*l.* per fathom. In *West Tolgus* there were some transactions early in the month at 47–9, and towards the close 49–51; the mine continues to hold out great promise. *New Seton* opened at 95–100, but about the middle of the month transactions were reported at 85–90, from which it again rallied to 90–100. *Rosewarne Consols* 4¾–5¼. In *Rosewall Hill and Ransome United*, there were a few transactions: they opened at 4–4¼, and closed at 3¾–4. In *South Phœnix* some business reported at 3⅛–3⅜.

In *North Treskerby* a good business has been doing, the mine is looking well, and took the chair at the last ticketing. Shares opened at 28–29 per 848; after the subdivision into 5,936 shares, they were first quoted at 3¾–4, from which they advanced to 4⅛–⅜, at which price they close. *South Frances* 95–100. *Stray Parks* have been in request during the month, and advanced from 32–34 to 35–36. *West Basset* quiet at 13–14: the mine is looking well, the next sampling is over 400 tons. *West Condurrow* 4–4¼.

There has been a large business doing in *East Basset*, shares opened 47–49, at about which price there was a good demand during the greater part of the month; they close from 50–52. *Clifford Amalgamated* has been dull, and declined from 23–25 to 22–24. *Wheal Grenville* has been flat, and has declined during the month 1*l.*, having opened 6–6¼, and closing at 5–5¼. *East Grenville* has also been dull, at a decline of about 5*s.* or 6*s.* per share; transactions having just been reported 47–49. *Wheal Unitys* have been a little more inquired for at a slight advance, quoted at per 16*s.*, 17*s.*, to 17*s.*, 18*s.* *Gonamena* are quoted at an advance of from 1¼–2 to 2¼–2¼.

Providence has been dull, and has gradually declined from 40–42 to 39–40. *Wheal Margaret* has similarly declined from 42–43 to 39–41. *Cook's Kitchen* has been dull with a drooping market, opened at 27–28, close 25–26. *Grambler and St. Aubyn* 14–16. *West Seton* have been in demand and scarce, and advanced from 235–240 to 240–250. *Wheal Kitty*, St. Agnes, 3¾–4. *South Condurrow*, 10*s.*, 15*s.* *Carn Camborne* nominally 15*s.*, 20*s.* *Treloweth* 1–1¼.

In *West Caradon* a considerable business has been doing, and prices advanced from 29–30 to 34–36, but afterwards slightly declined, closing at 32–34. *Wheal Trelawny* opened strong at 18–19, which price was maintained within a fraction till the middle of the month, when they were quoted at 17–18; at the close they were more inquired for at 18–18¼. In *Wheal Mary Ann* some transactions at 14–15. *North Basset*, 2¼–3. *West Rose Down* dull, 18–19. *Wheal Harriett*, 31–33. *Cargoll* have advanced, 22–24 with inquiries. *Wheal Uny*, a little stronger, advanced from 6¼ to 7¼.

Transactions are also reported in the following mines:—*Drake Walls*, 20*s.*, 21*s.* *Tolvadden*, 2¼–2¾. *St. Ives Consols*, 24–25. *Pendeen Consols*, 3¾–4¼. *Camborne Vean*, 1¾–2. *Sithney Carnmeal*, 2¾–3. *East Devon Consols*, 1¾–2. *South Carn Brea*, 2–2¼. *Pedn-an-drea*, 12*s.*, 14*s.* *Hingston Down*, 2¼–2½. *North Robert*, 20*s.*, 25*s.* *Wheal Buller*, 50–55. *Great Retallack*, 5*s.*, 7*s.* 6*d.* *Bottle Hill*, 10*s.*, 12*s.* 6*d.* *Copper Hill*, 70–80. *Wheal Orebor*, 8*s.*, 10*s.* *Wheal Pollard*, 10*s.*,

12*s.* 6*d.* *South Caradon Wheal Hooper*, 12*s.* 6*d.*, 15*s.* *Sortridge Consols*, 7*s.* 6*d.* *West Penstruthal*, 7½–8. *Wheal Agar*, 3–3½.

In Welsh mines, *Long Rake* is quoted at 15½–17, and were in demand at the end of the month. *Billins*, 15–17. *Bryn Gwiog*, 25–27. *North Minera*, 10*s.*, 12*s.*

In Colonial and Foreign mines, prices have been quoted as follows:—*Port Phillip*, 1½–1⅝. *Yudamanutana* from 2½–2⅜ to 2¾–3. *Great Northern Copper of South Australia*, ⅛–½. *Fortuna*, 3¼–3⅝. *United Mexican* opened 6¾, and after a good deal of fluctuations, closed at 7½. *Linares*, 6⅝ and 6⅜. *St. John Del Rey* opened 57¾, but steadily declined, closing at 56–56½. *Cobre*, 21⅞–22. *East Del Rey* declined from 1⅞–1⅝. *Scottish Australian*, 1–1⅞. *Worthing*, ½. *Dun Mountain*, ⅞. *Copiapo*, 7–8.

New undertakings have been quoted at the following prices:—*Cambrian Gold*, ⅜–⅝ prem. *St. David's Gold*, ⅛–⅜ prem. *Dolfrwynog*, ⅛–⅜ prem. *West Clogau*, par to ½ prem. *East Clogau*, 1–16 dis. to 1–16 prem.

Provincial Share Market.

DUBLIN.—The following report is condensed from the *Mining Journal*:—

At the end of August the closing price for Wicklow Copper shares was 41*l.*, and that for Mining Company of Ireland shares 18*l.* 5*s.* and 18*l.* 2*s.* 6*d.* General Mining Company for Ireland a shade firmer, though not much in request; they might have been readily procured at 5*l.*, but the best of the few offers made for them did not exceed 4*l.* 18*s.* 9*d.* In Connorree shares no business done. A few Carysfort shares, 1*l.* paid, sold at 15*s.*

In the beginning of September Wicklow Copper shares fell 30*s.* per share, but recovered, and maintained their former quotation of 41*l.* 10*s.* Carysforts, 1*l.* paid, might at one time have been procured at 13*s.*, but improved to 14*s.* 6*d.*, buyers. Connorree shares were also down for a few days to 25*s.*, and rose again to 27*s.*, sellers. General Mining Company for Ireland shares, firm at 5*l.* Mining Company of Ireland shares steady at 18*l.* 2*s.* 6*d.*

Towards the middle of the month General Mining Company for Ireland shares improved to 5*l.* 15*s.*—a rise of 15*s.* on last quotation. Carysfort shares (1*l.* paid) slightly improved on last price of 14*s.* 6*d.*, and exchanged hands at 15*s.*, at which they were in fair demand. Connorree shares weaker, and procurable at 26*s.* 6*d.*, buyers offering 26*s.* Wicklow Copper Company shares not firm at last quotation of 41*l.* 10*s.*, a few having been sold at 41*l.* 5*s.* The shares of the Mining Company of Ireland much in request, and brought 18*l.* 10*s.*, or an advance of 7*s.* 6*d.* per share for the week.

Towards the end of the month Wicklow Copper shares in demand, but buyers insisted on a smart reduction; they were quoted as low as 40*l.*, but closed at 40*l.* 10*s.*, being a reduction of 15*s.* per share on last rate. The shares of the Mining Company of Ireland more steady, and brought last price of 18*l.* 5*s.* to 18*l.* 10*s.* General Mining Company for Ireland shares dealt in at last quotation of 5*l.* 15*s.*, firm. Connorree shares not in demand, nor holders offering to sell under last prices of 1*l.* 6*s.* 6*d.* Carysfort shares in improved demand, and freely bought at 16*s.*, being a rise of 1*s.* 6*d.* on the shares of 1*l.* paid.

Tabular Abstract of Mining Accounts for the Month.

Date of Meeting.	Name of Mine, and Number of Shares.	Balances. Debit.	Balances. Credit.	Calls. Per Share.	Calls. Total.	Dividends. Per Share.	Dividends. Total
		£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
	CORNISH AND DEVON MINES.						
Aug. 15	Wheal Owles (80)	—	2,088 14 9	—	—	5 0 0	400 0 0
" 15	South Herodsfoot (1,024) ...	—	47 15 11	0 10 0	512 0 0	—	—
" 18	South Crofty (937)	1,864 14 4	—	1 10 0	1,405 10 0	—	—
" 19	Budnick Consols (5,850) ...	2,710 0 0	—	0 9 6	2,778 15 0	—	—
" 19	Wheal Union (6,000)	—	29 18 9	0 4 0	1,200 0 0	—	—
" 19	Botallack (400)	—	1,138 4 3	—	—	2 0 0	800 0 0
" 20	St. Ives Consols (940) ...	—	1,260 6 0	—	—	0 10 0	470 0 0
" 20	Wheal Grenville (5,844) ...	227 8 11	—	0 1 0	292 8 0	—	—
" 20	Clifford Amalgamated (2,900)	—	1,212 18 0	—	—	0 6 0	870 0 0
" 21	Hingston Down Consols (6,000)	293 19 8	—	0 1 6	450 0 0	—	—
" 22	Yarner (3,097)...	568 14 2	—	0 6 0	929 2 0	—	—
" 22	Boscaswell (1,248)	—	102 9 10	—	—	—	—
" 22	Carn Galver (190)	1,032 3 6	—	5 10 0	1,042 0 0	—	—
" 23	Devon Wheal Buller (4,566)...	—	38 2 8	0 5 0	1,141 10 0	—	—
" 25	East Falmouth (2,048) ...	—	285 12 10	0 2 6	256 0 0	—	—
" 25	Alfred Consols (4,943) ...	1,538 0 0	—	0 6 2	1,524 1 10	—	—
" 25	North Buller (1,024)	274 19 0	—	0 10 0	512 0 0	—	—
" 25	East Pool (128)	—	—	—	—	2 10 0	320 0 0
" 26	Pendeen Consols (5,000) ...	—	887 0 1	—	—	—	—
" 26	West Condurrow (1,218) ...	310 14 5	—	0 5 2	314 13 0	—	—
" 26	Great Work Consols (119) ...	1,262 15 9	—	—	—	—	—
" 26	East Carn Brea (6,000) ...	—	477 4 2	—	—	—	—
" 27	East Russell (4,000)	891 5 11	—	0 4 0	800 0 0	—	—
" 27	Providence (1,120)	—	1,409 0 0	—	—	1 0 0	1,120 0 0
" 27	Wheal Margaret (896) ...	—	1,793 19 6	—	—	1 5 0	1,120 0 0
" 27	North Basset (6,000)	247 8 4	—	0 5 0	1,500 0 0	—	—
" 28	Wheal Hearle (1,024) ...	—	673 0 0	—	—	—	—
" 28	Great South Tolgus (6,000) ...	—	1,303 18 3	—	—	—	—
" 28	Great Caradon (4,096) ...	47 7 1	—	0 2 0	409 12 0	—	—
" 28	Scorrier Consols (2,000) ...	431 7 5	—	0 7 6	750 0 0	—	—
" 29	North Downs (6,000)	—	579 7 10	—	—	—	—
" 29	Wheal Tremayne (1,022) ...	368 4 6	—	—	—	—	—
" 29	Condurrow (256)	2,624 1 1	—	—	—	—	—
Sept. 1	South Frances (496)	—	3,231 16 0	—	—	2 0 0	992 0 0
" 1	Millpool (256)	250 0 0	—	0 10 0	128 0 0	—	—
" 2	Grambler & St. Aubyn (486)	226 8 4	—	1 0 0	486 0 0	—	—
" 2	West Sharp Tor (256) ...	—	292 8 8	3 0 0	768 0 0	—	—
" 2	Polhigey Moor (6,000) ...	925 11 0	—	0 4 0	1,200 0 0	—	—
" 2	Lelant Consols (963)	103 13 2	—	0 10 0	481 10 0	—	—
" 3	Trelyon Consols (572) ...	332 5 7	—	—	—	—	—
" 6	Cook's Kitchen (2,450) ...	—	300 0 0	—	—	—	—
" 8	Wheal Jane (512)	—	170 16 9	—	—	—	—
" 9	Wheal Mary Ann (1,024) ...	—	2,443 1 9	—	—	0 10 0	512 0 0
" 9	North Treskerby (848) ...	—	903 4 7	—	—	0 10 0	424 0 0
" 9	North Roskear (700)	754 19 9	—	1 0 0	700 0 0	—	—
" 9	South Exmouth (5,000) ...	—	22 0 6	0 5 0	1,250 0 0	—	—
" 10	Caradon Consols (914) ...	20 2 7	—	0 12 6	571 5 0	—	—
" 12	Cargoll (916)	—	774 18 0	—	—	—	—
" 12	Spearne Moor (280)	389 8 4	—	—	—	—	—
" 12	Frank Mills (5,000)	—	1,362 7 7	—	—	—	—
" 15	West Damsell (256)	—	447 2 5	—	—	—	—
" 16	Buller and Basset (6,380)	617 2 5	—	0 3 0	957 0 0	—	—
" 16	Wheal Buller (256)...............	—	774 1 11	—	—	—	—
" 17	Gurlyn (4,910)	187 0 2	—	—	—	—	—
" 17	Great Wheal Vor (5,908)	—	2,975 16 9	—	—	—	—
" 17	East Grylls (1,024)...............	—	822 12 11	—	—	—	—
" 17	Wheal Grylls (2,048)	—	801 11 10	—	—	0 10 0	512 0 0
" 18	Bedford United (4,000)	—	1,257 11 0	—	—	0 2 0	400 0 0
" 18	East Rosewarne (5,000).........	246 19 3	—	0 1 0	250 0 0	—	—
" 19	Devon Great Consols (1,024)	—	33,819 16 10	—	—	9 0 0	9,216 0 6
	WELSH MINES.						
Aug. 21	Mount Pleasant (640)	—	—	—	—	0 7 6	240 0 0
" 27	Billins (200)	100 7 8	—	3 0 0	600 0 0	—	—
	Long Rake (500).....................	527 17 1	—	1 0 0	500 0 0	—	—
	FOREIGN MINE.						
Sept. 11	Linares (15,000)	—	—	—	—	0 5 0	3,750 0 0

Prices Current of Metals.

From Messrs. JAMES and SHAKSPEARE's, 10, Austin Friars, E.C.

			Per Ton.		
IRON	Bars	in Wales ..	£5 12 6	@	£5 15 0
	"	" Liverpool	——		6 5 0
	"	" London	6 15 0	"	7 0 0
	Nail Rods	" Wales	6 2 6	"	6 5 0
	"	" Liverpool	6 15 0	"	7 0 0
	"	" London	——	"	7 0 0
	Hoops (Staffordshire)	" Liverpool	7 15 0	"	8 0 0
	" "	" London	8 5 0	"	8 10 0
	Sheets "	" Liverpool	8 10 0	"	9 5 0
	" "	" London	9 0 0	"	9 10 0
	Bars "	" Liverpool	6 15 0	"	7 0 0
	" "	" London	7 2 6	"	7 5 0
	Scotch Pig (No. 1. g.m.b.)	the Clyde	2 17 0	"	2 17 6
	Rails	in Wales	——	"	5 15 0
	Russian	C.C.N.D.	——		——
	Swedish—Hammered—large sizes		——	"	11 5 0
	" "	Indian sizes	11 10 0	"	11 15 0
STEEL	Hammered—faggot		——		16 10 0
	" in kegs ¼ and ⅛ in...		15 0 0		15 10 0
COPPER	Australian and other *fine* Foreign		100 0 0	"	102 0 0
	Foreign Slab, for Prod. 96 per Cent.		——	"	92 0 0
	English Tile and Tough		——	"	98 0 0
	" Best selected		——	"	101 0 0
	" Sheets, Sheathing and Rod		——	"	105 0 0
	" Flat Bottoms		——	"	110 0 0
			Per lb.		
YELLOW METAL	Sheets, Sheathing and Rod		——	"	9½*d.*
			Per Cwt.		
TIN .... English ..	Common Blocks and Ingots		——	"	115*s.*
	" Bars (in barrels)		——	"	116*s.*
	Refined		——	"	120*s.*
Foreign ..	Straits		——	"	116*s.*
	Banca		——	"	118*s.*
			Per Box.		
TIN PLATES at Liverpool 6*d.* Less	Charcoal IC, best..............		28*s.*	"	29*s.*
	" IX "		34*s.*	"	35*s.*
	Coke IC		22*s.*	"	23*s.* 6*d.*
	" IX		28*s.*	"	29*s.* 6*d.*
			Per Ton.		
LEAD..........	Sheet		——	"	20 10 0
	Pig—W.B.		21 5 0	"	21 10 0
	" Ordinary brands		20 5 0	"	20 10 0
	" Foreign, soft..............		——	"	19 15 0
	Red		——	"	21 10 0
	Shot		——	"	23 10 0
	Dry White..................		——	"	27 10 0
SPELTER	(Cake)		19 0 0	"	19 5 0
ZINC	(Sheet)		——	"	23 10 0
			Per Bottle.		
QUICKSILVER	(in bottles containing 75lbs. each)		——	"	7 0 0
			Per Ton.		
REGULUS OF ANTIMONY,	French Star		43 0 0	"	43 10 0

The tone of the Metal Market has greatly improved the last week, and quotations for all articles are firm.

IRON.—*Welsh* and *Staffordshire* are in good demand at an advance of about 5*s.* per ton.

COPPER.—The inquiry for all descriptions continues, and a large business has been done in *Burra* at £100 per ton; of this and *Kapunda* there is now but little obtainable, and for the small quantity of the latter in importers' hands £105 is asked.

TIN.—Smelters of *English* declared yesterday a rise of 4*s.* per cwt. This move has caused an advance in *Straits* for which 116*s.* has been paid; previously a good business was done at 113*s.* @ 114*s.*

SPELTER.—Two or three thousand tons have been sold this week both on the spot and to arrive at £18 15*s.* @ £19 2*s.* 6*d.* per ton.

Copper Ores.

Sampled Aug. 13, and sold at Tabb's Hotel, Redruth, Aug. 28.

Mines.	Tons.	Purchasers.	Price.		
South Caradon	94	7	£5	15	0
	29	7, 9	7	11	6
	82	11	5	12	6
	52	1, 2, 6	17	5	0
	50	1, 6	21	4	0
	46	2, 9	6	0	6
	41	7	5	12	0
Fowey Consols	94	5, 9	5	9	0
	90	7	5	14	0
	76	1, 5	1	10	6
	70	1, 5	5	16	0
	52	1, 5	3	5	0
	46	1, 5	4	0	6
Great Wheal Busy......	75	6	2	16	6
	72	12	1	18	6
	68	6	3	7	6
	60	6	4	2	6
	51	6	3	16	0
	37	6	2	3	6
	30	12	2	10	6
	28	2	3	13	6
Wheal Damsel	81	7	4	1	0
	79	10	4	4	0
	76	3	4	5	0
	54	7, 10	1	6	0
	47	7	5	5	6
	44	9	5	1	0
Clifford Amalgamated	58	5	5	8	0
(United Mines)	57	3	4	6	0
	45	9	2	13	0
	42	1, 5	0	13	6
Clifford Amalgamated	34	9	£2	5	6
	28	10	1	8	0
Craddock Moor	64	1, 6	7	14	6
	45	1, 6	7	15	6
	27	2	5	11	0
	26	9	5	12	0
	15	5	4	3	0
Prideaux Wood	57	1	3	0	6
	56	1	3	0	6
Wheal Polmear	50	13	4	3	0
	42	12	3	14	6
	18	5	6	10	0
South Crinnis	50	6	3	16	6
	32	6	3	6	6
	18	1	10	11	6
Great Briggan	62	2	4	11	6
Great North Downs ...	62	13	5	13	0
North Grambler.........	56	6	6	4	6
East Polmear	30	5	7	3	0
Grambler & St. Aubyn	25	7	5	7	6
Falmouth and Sperries	23	5	3	10	0
Wheal Moyle	15	7	3	10	0
	7	12	4	1	6
Wheal Jane..............	18	1, 5	5	0	0
Treveddoe	12	8	4	10	6
	5	8	0	13	0
Creegbrawse	15	5	3	2	0
Buckingham's Ore......	15	12	2	3	6
North Wheal Busy......	7	12	5	13	6
Wheal Cubit	3	1	9	16	6

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.		
South Caradon	454	£4,139	13	6
Fowey Consols..................	428	1,902	13	0
Great Wheal Busy	416	1,263	10	0
West Damsel	381	1,523	3	6
Clifford Amalgamated	264	822	9	0
Craddock Moor	177	1,201	19	6
Prideaux Wood	113	341	16	0
Wheal Polmear	110	480	19	0
South Crinnis	100	488	0	0
Great Briggan..................	62	283	13	0
Great North Downs	62	350	6	0
North Grambler	56	£342	7	6
East Polmear	30	214	10	0
Grambler & St. Aubyn	25	134	7	6
Falmouth & Sperries	23	80	10	0
Wheal Moyle.........................	22	81	0	6
Wheal Jane	18	90	0	0
Treveddoe	17	57	11	0
Creegbrawse	15	46	10	0
Buckingham's Ore	15	32	12	6
North Busy	7	39	14	5
Wheal Cubit	3	29	9	6

EACH COMPANY'S PURCHASE.

		Tons.	Amount		
1	Vivian and Sons	376½	£2,160	10	9
2	Freeman and Co.	175½	1,164	6	6
3	Grenfell and Sons	133	568	2	0
4	Crown Copper Co..........	—	—		
5	Sims, Willyams & Co. ..	383½	1,628	3	6
6	Williams, Foster & Co. ...	482 5-6	2,756	19	3
7	Mason and Elkington ...	464½	2,418	2	9
8	Bankart and Sons	17	57	11	0
9	Copper Miners' Co.	263½	1,296	4	3
10	Charles Lambert	134	406	2	0
11	Newton, Keates & Co. ...	82	461	5	0
12	Sweetland and Co.	173	471	13	6
13	Neath Copper Co.	112	557	16	0
	Total	2797	£13,946	16	6

Average Produce, 6⅜.
Quantity of Fine Copper, 177 tons 7 cwt.

Average Standard £122 0 0
Average Price per ton 4 19 6

Copper Ores.

Sampled Aug. 20, and sold at Tyack's Hotel, Camborne, Sept. 4.

Mines.	Tons.	Purchasers.	Price.
Clifford Amalgamated	112	6	£5 14 0
(Wheal Clifford)	110	12	5 6 0
	101	7, 9	4 10 0
	100	3	5 13 0
	85	2, 6	3 15 0
	83	7	3 14 6
	81	3	7 5 0
	80	3	7 17 0
	75	5, 7	4 1 0
	60	3, 12	6 7 6
	55	2	5 5 0
West Seton	95	3	7 16 0
	94	1, 2, 7	2 17 6
	77	1, 6	8 5 6
	69	7	5 3 0
	68	5	4 10 6
	43	3	5 18 6
	41	1, 3, 6	9 14 6
Tywarnhaile	81	1, 5	2 9 0
	80	7, 9	6 6 0
	72	9	3 3 6
	64	7	2 9 6
South Tolgus	57	5	3 12 6
	52	1, 6	9 8 6
	50	5, 11	3 19 0
	48	7	7 4 6
	25	7	6 3 0
South Frances	73	9	5 13 0
	71	6	5 8 0
	62	1, 5, 9	6 0 6
	21	7	13 14 0
East Pool	75	5	4 12 6
	72	5	5 9 0
	63	5	5 9 0
Wheal Seton	35	5	4 1 0
(Pendarves)	80	5	6 5 0

Mines.	Tons.	Purchasers.	Price.
Wh. Seton (Pendvs.)	63	5, 10	£4 3 0
	27	1, 6	14 1 6
	5	12	2 18 6
Wheal Basset	80	13	5 18 6
	53	1, 7, 9	13 12 6
	42	1	6 1 6
	22	1, 7	9 12 6
North Roskear (Enys)	46	6	8 12 0
	37	2, 6	10 16 0
	26	3	2 13 6
(Basset)	43	10	4 1 6
(Pendarves)	35	10	4 5 6
East Basset	44	1, 2	7 1 6
	39	7	4 7 0
	32	1	10 13 6
	30	9	3 15 6
Tolcarne	43	9	6 19 6
	34	12	6 0 6
	26	5	4 13 0
West Stray Park	58	6	7 9 0
	34	6	5 6 6
Wheal Uny	38	3	7 11 0
	23	11	10 3 0
Tresavean	50	12	2 2 6
	8	12	3 15 6
	1	5	11 15 0
Wheal Harriett	25	6	7 5 0
	15	8	2 9 6
Pedn-an-drea	30	1, 5, 13	3 5 0
	2	2	13 12 0
West Tolgus	31	5	5 8 0
North Crofty	29	2	6 12 0
North Frances	15	5	7 3 0
Crane	11	1, 5	11 7 6
	4	1, 5	4 0 0
Cook's Kitchen	13	5	2 0 6

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.
Clifford Amalgamated	942	£5,059 1 6
West Seton	487	2,964 19 6
Tywarnhaile	297	1,089 9 0
South Tolgus	232	1,394 15 6
South Frances	227	1,457 2 0
East Pool	210	1,082 12 6
Wheal Seton	210	1,296 17 0
Wheal Basset	197	1,663 0 6
North Roskear	187	1,189 12 0
East Basset	145	935 16 0
Tolcarne	103	625 13 6
West Stray Park	92	£613 3 0
Wheal Uny	61	520 7 0
Tresavean	59	140 4 0
Wheal Harriett	40	218 7 6
Pedn-an-drea	32	124 14 0
West Tolgus	31	167 8 0
North Crofty	28	191 8 0
North Frances	15	107 5 0
Crane	15	140 18 6
Cook's Kitchen	13	26 6 6

EACH COMPANY'S PURCHASE.

		Tons.	Amount.
1	Vivian and Sons	326½	£2,402 6 7
2	Freeman and Co.	200½	1,112 5 2
3	Grenfell and Sons	506¾	3,456 12 8
4	Crown Copper Co.	—	—
5	Sims, Willyams & Co.	708¾	3,380 7 7
6	Williams, Foster & Co.	498¾	3,457 10 8
7	Mason and Elkington	537	2,848 12 4
8	Bankart and Sons	15	37 2 6
9	Copper Miners' Co.	346-17½	£1,898 14 0
10	Charles Lambert	109½	455 11 6
11	Newton, Keats & Co.	48	332 4 0
12	Sweetland, Tuttle & Co.	237	1,122 3 6
13	Neath Copper Co.	90	506 10 0
	Total	3624	£21,010 0 6

Average Produce, 7.
Quantity of Fine Copper, 253 tons 4 cwts.

Average Standard £122 7 0
Average price per ton 5 16 0

Copper Ores.

Sampled Aug. 27, and sold at Tabb's Hotel, Redruth, Sept. 11.

Mines.	Tons.	Purchasers.	Price.
West Basset	77	13	£4 15 0
	72	7	5 12 0
	70	5	4 4 6
	66	9	7 2 0
	53	8, 12	5 2 0
	47	5, 7	5 1 0
	40	9	5 8 0
	35	5	4 4 0
	34	5, 7	6 17 0
	30	5	9 18 0
East Carn Brea	70	3	5 2 0
	67	3	13 0 0
	66	5, 9	4 1 6
	62	3	5 18 6
	46	3	10 1 0
	44	7	5 0 0
	43	3	9 14 0
	37	3	5 7 0
	18	2	5 17 6
	15	8	3 9 0
Alfred Consols	60	7	2 19 6
	45	10	0 19 6
	44	6, 10	4 0 6
	38	10	3 13 0
	35	7	3 16 0
	30	10	1 7 0
	29	6	8 8 0
	9	10	1 19 6
Par Consols	68	3, 5	9 4 0
	65	2, 6	8 8 0
	55	3	7 7 0
	44	8	1 15 6
Wheal Margery	69	6	8 13 6
	65	12	2 18 0
	64	6	2 15 6
Wheal Margery	6	5	£12 9 0
Tolvadden	56	2	4 7 0
	54	9	4 19 0
	38	7	4 9 6
	14	1	13 16 6
	7	8	2 0 6
	6	9	13 13 6
Copper Hill	44	7, 10	2 4 0
	42	13	3 1 6
	40	5	7 11 0
Wheal Agar	46	5	6 5 0
	38	6	6 5 6
	25	2	6 8 0
East Rosewarne	42	6	7 7 6
	26	8	4 19 6
	18	9	4 0 6
	15	7	8 1 6
Wheal Buller	55	7	3 18 6
	39	7	10 2 6
South Crenver	83	5	2 7 0
	9	2	6 12 0
Prosper United	37	5	5 13 0
	26	8	2 12 6
	21	5	4 0 0
Wheal Anna	54	6	7 5 6
	28	13	4 1 6
Gurlyn	57	9	5 4 6
	25	5, 9	10 3 0
North Basset	44	7	4 7 0
	28	12	3 14 6
South Carn Brea	36	7	4 6 0
West Trevelyan	33	5	7 11 6
	3	5	1 16 0
Champion's Ore	21	12	4 5 6

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.
West Basset	524	£2,933 17 0
East Carn Brea	468	3,319 3 0
Alfred Consols	290	973 1 0
Par Consols	232	1,653 19 0
Wheal Margery	204	1,039 7 6
Tolvadden	175	970 14 6
Copper Hill	126	527 19 0
Wheal Agar	109	685 19 0
East Rosewarne	101	632 13 6
Wheal Buller	94	£610 15 0
South Crenver	92	254 9 0
Prosper United	83	358 13 6
Wheal Anna	82	506 19 0
Gurlyn	82	551 11 6
North Basset	72	295 14 0
South Carn Brea	36	154 16 0
West Trevelyan	36	255 7 6
Champion's Ore	28	119 14 0

EACH COMPANY'S PURCHASE.

	Tons.	Amount.
1 Vivian and Sons	14	£193 11 0
2 Freeman and Co.	140½	841 15 0
3 Grenfell and Sons	414	3,389 15 0
4 Crown Copper Co.	—	——
5 Sims, Willyams & Co.	524	2,957 14 0
6 Williams, Foster & Co.	350½	2,420 7 6
7 Mason and Elkington	500½	2,466 7 0
8 Bankart and Sons	143½	474 3 0
9 Copper Miners' Co.	286½	1,666 11 6
10 Charles Lambert	166	377 16 0
11 Newton, Keates & Co.	—	——
12 Sweetland, Tuttle & Co.	147½	447 13 0
13 Neath Copper Co.	147	609 0 0
Total	2834	£15,844 13 0

Average Produce, 6⅝.
Quantity of Fine Copper, 189 tons 6 cwt.

Average Standard £124 17 0
Average Price per ton 5 12 0

Copper Ores.

Sampled Sept. 3, and sold at the Royal Hotel, Truro, Sept. 18.

Mines.	Tons.	Purchasers.	Price. £	s.	d.
Devon Gt. Consols ...	129	6	£4	15	0
	122	6	4	1	0
	119	2	4	11	6
	118	6	4	11	6
	114	13	4	5	6
	112	2	4	1	6
	111	6	4	4	0
	109	11	4	5	6
	108	6	3	16	6
	94	9, 11	9	3	6
	93	9	5	4	0
	90	3	9	3	6
	85	3	8	19	0
	83	10	2	1	0
	75	3	8	16	6
	73	12	4	4	0
	72	12	5	1	6
	71	10	3	14	0
	65	3	6	16	0
	64	12	2	17	6
	58	10	1	5	6
	57	8	4	10	6
	52	3	8	16	6
	32	1	2	13	6
	28	9	5	11	6
	26	3	17	0	0
	25	7	6	6	0
Great Wh. Martha ...	113	1, 5	1	14	0
	90	1, 5	1	12	6
	86	1, 5	2	1	6
	75	1, 5	0	18	0
	72	10	0	17	0
	71	1, 5	0	18	0
	58	1, 5	3	0	0
	39	1, 5	5	15	6
East Caradon	99	1	5	4	6
	95	1, 10	5	7	6
	93	1	5	14	6
	60	1, 5	10	8	6
	56	1, 5	8	7	6
	51	1	11	1	6
Phœnix Mines	87	8	5	14	0
	85	7	4	1	6
	84	8	4	7	0
	71	2	4	3	6
	64	5	2	18	6
Phœnix Mines	40	6	£6	5	0
	22	1	2	18	6
Marke Valley	100	12	4	10	6
	95	12	4	7	6
	86	10	3	10	0
	78	8	3	14	6
	61	12	2	10	6
Hingston Down	72	7	3	4	0
	71	8	3	19	6
	69	7, 10	2	12	0
	62	9	3	7	0
	61	10	2	12	0
	58	9	5	5	6
Bedford United.........	110	3, 9	4	16	6
	103	8	3	17	6
Holmbush	64	7, 9	8	9	6
	56	7	11	11	0
	51	7	9	9	0
	29	13	8	8	6
East Russell	104	1	4	15	6
	50	5	5	7	0
	46	5	5	4	0
Lady Bertha	70	9	1	15	0
	60	13	2	4	0
	40	8	3	15	6
Wheal Friendship ...	89	9	8	12	6
	69	9	9	15	6
Kelly Bray...............	45	7	4	12	6
	41	7, 10, 13	1	11	6
	40	8	6	3	6
	24	7	2	14	0
Wheal Emma	51	6	6	19	6
	50	6	8	12	6
	40	1	1	7	6
South Bedford	62	13	4	3	6
	50	13	1	10	6
Wheal Edward	78	6	5	1	0
	31	10	2	6	6
Calstock Consols	52	13	4	5	0
	33	13	4	12	0
Gawton	79	10	8	1	6
Brookwood	67	5	5	14	6
	3	9	17	1	0
Fursdon	44	6	7	16	6
Crowndale	32	10	1	1	6
Hawkmoor	27	3, 13	4	15	0

TOTAL PRODUCE AND VALUE.

	Tons	Amount. £	s.	d.
Devon Great Consols......	2,185	£11,437	8	0
Great Wheal Martha......	604	1,108	12	6
East Caradon	454	3,219	13	0
Phœnix Mines...............	453	2,005	13	0
Marke Valley	420	1,613	14	0
Hingston Down	393	1,364	5	6
Bedford United	213	874	17	6
Holmbush	200	1,770	9	6
East Russell	200	1,003	6	0
Lady Bertha	170	405	10	0
Wheal Friendship	158	997	2	0
Kelly Bray	150	£584	10	0
Wheal Emma......................	141	591	19	6
South Bedford	112	335	2	0
Wheal Edward	109	465	19	6
Calstock Consols ...	85	372	16	0
Gawton	79	242	18	6
Brookwood.......................	70	434	14	6
Fursdon	44	344	6	0
Crowndale	32	34	8	0
Hawkmoor.......................	27	128	5	0

EACH COMPANY'S PURCHASE.

		Tons.	Amount. £	s.	d.
1	Vivian and Sons............	812½	£3,642	7	0
2	Freeman and Co.	302	1,297	5	0
3	Grenfell and Sons	461½	3,893	5	6
4	Crown Copper Co...........	—	—		
5	Sims, Willyams & Co. ...	551	2,148	8	9
6	Williams, Foster & Co....	851	4,051	3	6
7	Mason and Elkington ...	438½	2,158	7	6
8	Bankart and Sons	560	2,489	2	6
9	Copper Miners' Co.	636	£3,330	8	0
10	Charles Lambert	668¾	1,743	10	9
11	Newton, Keates & Co...	156	897	4	0
12	Sweetland, Tuttle & Co.	465	1,878	3	0
13	Neath Copper Co.	397½	1,440	4	6
	Total	6289	£29,335	10	0

Average Produce, 5½.
Quantity of Fine Copper, 359 tons 9 cwt.

Average Standard £129 16 0
Average Price per ton............ £4 13 0

Copper Ores.

Sampled Aug. 20, and sold at Swansea Sept. 9.

Mines.	Tons.	Produce.	Purchasers.	Price.		
Berehaven	129	10⅜	2, 7	£8	13	3
	123	10	13	8	12	0
	106	10⅜	7, 13	8	12	0
	83	10⅛	13	8	12	0
Ookip	43	36⅛	3	33	1	0
	42	37¼	3	33	9	0
	33	32	3	28	13	0
Wheal Maria	32	32⅝	13	29	10	0
	15	25⅛	3. 13	22	15	0
Springbok	6	24⅝	13	22	0	0
	12	20⅛	10	8	13	6
	11	33⅛	10	30	7	6
	9	25	10	22	13	6
	24	22	10	19	18	6
	3	32⅝	2	29	9	0
Wheal Maria	25	31¼	2	28	1	6
	2	29⅛	2	26	5	0
Ookip	10	36	3	32	6	0
	2	29	3	26	0	0
Springbok	6	23⅛	7	£20	19	0
Chili	94	14⅜	3	12	16	0
	72	13⅜	10	12	7	6
	66	15⅛	3	13	16	0
Cobre	12	14⅝	7	12	7	0
	59	25⅛	7	22	3	6
	42	21⅜	9	18	12	6
	41	21⅛	9	19	3	6
Ballycummisk	4	20	7	18	0	6
	36	15	10	13	7	6
	10	9	7	7	15	0
	38	5⅛	1, 7	4	5	0
Bathurst	17	21⅞	7	19	4	6
British Reg.	16	38⅝	10	35	10	6
Cronebane	2	27⅛	5	23	8	0
Tigrony	2	26	5	22	3	0
London	1	11⅛	1	8	0	0
	1	10⅜	1	7	0	0
Phœnix	1	2⅛	5	0	14	0

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.		
Berehaven	441	£3,799	1	0
Ookip	118	3,771	10	0
Wheal Maria	47	1,285	5	0
Springbok	65	1,460	17	0
Wheal Maria	27	754	7	6
Ookip	12	375	0	0
Springbok	6	125	14	0
Chili	232	3,005	0	0
Cobre	154	£3,024	19	0
Ballycummisk	88	792	12	0
Bathurst	17	326	16	6
British Regulus	16	568	8	0
Cronebane	2	46	16	0
Tigrony	2	44	6	0
London	2	15	0	0
Phœnix	1	0	14	0

EACH COMPANY'S PURCHASE.

		Tons.	Amount.		
1	Copper Miners' Co.	21	£ 95	15	0
2	Freeman and Co	94⅜	1,400	13	0
3	Grenfell and Sons	297⅜	6,431	2	6
4	Crown Copper Co.	—	—		
5	Sims, Willyams & Co.	5	91	16	0
6	Vivian and Sons	—	—		
7	Williams, Foster & Co	244⅜	3,153	2	6
8	British and For. Copper Co.	—	—		
9	Mason and Elkington	83	1,568	8	6
10	Bankart and Sons	180	£3,181	8	0
11	Charles Lambert	—	—		
12	Ravenhead Copper Co.	—	—		
13	Sweetland, Tuttle & Co.	304⅜	3,474	0	6
14	Jennings and Co	—	—		
15	Neath Copper Co.	—	—		
	Total	1230	£19,396	6	0

Black Tin Sales.

Date.		Mines.	Tons.	c.	q.	lbs.	Price per ton £	s.	d.	Purchasers.	Amount of Money. £	s.	d.
Aug.	20.	Wheal Union	1	19	2	11	63	10	0	Bissoe Co.	125	14	5
„	21.	East Birch Tor	1	1	0	9	64	12	6	Calenick Co.	68	2	3
		Great Work	11	12	2	16	70	5	0	Chyandour Co.	817	3	0
„	23.	So. Carn Brea	6	6	0	11	61	5	0	ditto	714	3	9
		„	5	7	0	12	61	5	0	Bissoe Co.			
„	26.	Great Work	10	18	0	0	70	5	0	Chyandour Co.	765	14	6
		Gt. Wh. Busy	17	11	3	0	—			Calenick Co.	998	2	2
Sept.	6.	Gt. Wh. Fortune	20	5	1	16	—			Mellanear Co.	1403	13	5
		Gurlyn	7	11	1	18	63	0	0	Chyandour Co.	476	18	6
		St. Day United	30	13	0	13	—			Harvey & Co.	1655	8	2
		North Basset	3	18	3	10	63	0	0	Bissoe Co.	248	6	10
		Kitty (St. Agnes)	6	6	0	24	—			—	764	16	11
		Penhalls	5	5	0	21	—			—	330	6	6

Copper Ores.

Sampled Sept. 3, and sold at Swansea, Sept. 23.

Mines.	Tons.	Produce.	Purchasers.	Price.		
Cuba	100	11¼	1, 3, 7	£9	16	0
	98	11½	3	9	18	0
	95	11⅝	3	10	5	0
	94	11½	15	9	19	6
	93	11⅜	6	9	19	0
(Precip. S.J.M.)	8	66¼	10	57	12	6
	59	17⅞	7	15	17	0
	48	20⅞	7	18	16	6
	42	20¼	2	18	4	6
(Precip. S.J.M.)	7	66	5	57	4	0
	2	69	5	60	11	0
Knockmahon	92	9⅞	1	8	15	0
	90	9⅞	7	8	16	6
Knockmahon	93	10	9	£8	19	6
	71	10¼	1, 15	9	9	6
	68	10⅝	9	9	13	0
	93	11⅞	2, 7	10	14	0
	91	11⅝	2	10	11	6
Berehaven	98	8⅞	6	7	15	0
	57	8⅞	5, 9	7	15	6
	128	10⅝	6	9	6	0
	115	10⅝	5	9	5	0
Laxey	88	6½	1, 3	5	10	6
	51	4½	11	3	12	0
Canobolas	32	15⅝	2, 7	13	17	0
Lochwinnoch	19	9⅝	14	8	6	6

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.		
Cuba	646	£8,373	13	0
Knockmahon	598	5,720	5	6
Berehaven	398	3,456	16	6
Laxey	139	£667	5	0
Canobolas	32	443	4	0
Lochwinnoch	12	158	3	6

EACH COMPANY'S PURCHASE.

	Tons.	Amount.		
1 Copper Miners' Co.	204⅜	£1,711	2	7
2 Freeman and Co.	195⅝	2,446	18	6
3 Grenfell and Sons	270⅞	2,513	14	4
4 Crown Copper Co.	3	—		
5 Sims, Willyams & Co.	152⅞	1,806	16	9
6 Vivian and Sons	319	2,875	5	0
7 Williams, Foster & Co.	292⅞	3,678	16	4
8 British and For. Copper Co.	—	—		
9 Mason and Elkington	189⅞	1,712	9	3
10 Bankart and Sons	8	461	0	0
11 Charles Lambert	51	181	1	0
12 Ravenhead Copper Co.	—	—		
13 Sweetland, Tuttle & Co.	—	—		
14 Jennings and Co.	19	158	3	6
15 Neath Copper Co.	129⅞	1,274	0	3
Total	1832	£18,819	7	6

Sundry Copper Ore Sales.

Date.	Mines.		Tons.	Price per ton. £ s. d.	Purchasers.	Amount of Money. £ s. d.
Aug. 25.	Knockmahon.		71	9 11 6	St. Helen's Co.	1366 15 0
			71	9 13 6	Newton, Keates, & Co.	
Sept. 19.	Parys Mines	Lot 1	100	6 4 0	J. Radley, jr. & Mona Co.	1289 10 0
		2	75	6 18 0	C. Lambert & Mona Co.	
		3	80	1 18 0	ditto	

Blende Sales.

Date.	Mines.	Tons.	Price per ton. £ s. d.	Purchasers.	Amount of Money. £ s. d.
Sept. 2.	Minera	20	2 15 6	W. Kenrick	281 3 0
	,,	57	3 1 0	ditto	
	,,	28	1 10 0	Vivian & Sons	

Lead Ore Sales.

Dates.	Mines.	Tons.	Price per Ton. £	s.	d.	Purchasers.	Amount of Money. £	s.	d.
Aug. 21.	Harwood	7	11	17	6	London Lead Co.	83	2	6
" 23.	Dyliffe	66	12	13	6	Newton, Keates & Co.			
	"	55	12	14	0	Adam Eyton	2042	1	0
	"	40	12	13	6	Walker, Parker & Co.			
	Llanerchyraur	29	13	18	0	Newton, Keates & Co.	680	12	0
	"	20	13	17	6	A. Courage and Co.			
	Dyfngwm	17	12	8	6	Newton, Keates & Co.	452	1	0
	"	19	12	13	6	A. Courage and Co.			
	Aberdovey	18½	12	6	0	Walker, Parker & Co.	227	11	0
" 28.	Westminster	20	11	18	6	ditto	238	10	0
	Mount Pleasant	16	12	5	0	Adam Eyton	196	0	0
	Hendre Ucha	20	12	14	0	ditto	254	0	0
	Cefn Cilcen	6	12	18	6	ditto	77	11	0
	Pennant	1	14	5	0	Newton, Keates & Co.			
	"	11	13	2	6	Adam Eyton	259	0	6
	"	8	12	11	0	ditto			
	North Carrock	13	7	0	6	Newton, Keates & Co.	91	6	6
	Foxdale	100	22	12	6	Walker, Parker & Co.	2262	10	0
" 30.	Cwmbrane	24½	12	4	0	Sims, Willyams & Co.	298	18	0
Sept. 1.	East Logylas	70	12	5	0	Panther Co.	857	10	0
	Glogfach	60	15	2	0	ditto	907	10	0
	Cwmystwith	50	12	12	0	ditto	1255	0	0
	"	50	12	10	0	ditto			
" 2.	Minera	50	12	12	6	ditto			
	"	50	12	12	6	Walker, Parker & Co.			
	"	100	12	13	0	ditto			
	"	100	12	14	0	ditto			
	"	56	13	0	0	Panther Co.	7774	5	0
	"	50	12	17	6	ditto			
	"	100	13	2	6	ditto			
	"	100	12	18	6	Walker, Parker & Co.			
" 3.	Wheal Mary Ann	56	28	4	0	Sims, Willyams & Co.	1579	4	0
" 4.	Laxey	100	18	0	0	ditto	1800	0	0
" 5.	Chiverton	65	17	13	6	R. Michell and Son	1131	4	0
	Wheal Frank Mills	55	13	10	6	ditto	1376	7	6
	"	50	12	13	0	Stock and Co.			
	South Exmouth	75	12	3	6	T. Somers	1562	15	0
	"	55	12	3	5	ditto			
" 10.	Bronfloyd United	30	13	10	0	Stock and Co.	405	0	0
" 11.	Talargoch (Maesyrerwddu)	42½	13	7	0	Adam Eyton	2093	17	6
	" (Coetia Llys)	107½	14	4	0	ditto			
	Deep Level	10	12	3	6	Newton, Keates & Co.	121	15	0
	Rhosesmor	73	13	5	0	Adam Eyton	1900	0	0
	"	70	13	6	6	Walker, Parker & Co.			
	Orsedd	3	13	1	0	Adam Eyton	39	3	0
	Parry's	30	13	1	0	ditto	391	10	0
	Bryngwiog	40	13	2	6	Walker, Parker & Co.	525	0	0
	Long Rake	20	12	14	6	Newton, Keates & Co.	254	10	0
	West Merllyn	4	13	5	0	Adam Eyton	53	0	0
	Trelogan	5	12	1	6	Walker, Parker & Co.	60	7	6
	Ty Maen	3	13	0	6	ditto	39	1	6
	Pwll Bramwell	4½	13	3	0	Newton, Keates & Co.	59	3	6
	Merllyn	3½	12	3	6	Walker, Parker & Co.	42	12	3
	Llangynog United	18	12	13	0	Newton, Keates & Co.	227	14	0
	North Carrock	10½	11	16	0	ditto	123	18	0
	Minera Union	14	12	10	6	ditto	175	7	0
	Dyliffe	28	12	10	6	Walker, Parker & Co.	350	14	0
" 12.	Llanfyrnach	20	13	2	6	ditto	262	10	0
" 15.	Frongoch	80	12	4	6	ditto	1948	0	0
	"	80	12	2	6	ditto			
	East Darren	75	15	3	0	Sims, Willyams & Co.	1136	5	0
	Cefn Brwyno	51	12	16	0	ditto	652	16	0
	Cwm Erfin	27	15	4	6	Treffry's Estate	791	9	0
	"	25	15	3	6	Walker, Parker & Co.			

THE

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The Manufacture of Pig-Iron in Scotland.

(*Foundry Pig.*)

BY MM. GRUNER AND LAN.

(Abstracted from the *Annales des Mines*, 5th series, vol. xx, p. 183.)

(*Continued from page 206.*)

VI. *Discussion on the Results of the Manufacture of Pig-iron in Scotland.*—We shall conclude what bears on the technical part of the manufacture of pig-iron in Scotland by discussing the results, both in respect to (1) *the quality of the products*, and (2) *the consumption of the raw materials, cost of labour, and general expenses.*

1. *Quality of the Products.*—In this respect there can be no better test than the commercial classification, particularly where, as in Scotland, the products have been for a lengthened period the objects of a large and special business. Now, the commercial classification of Scotch pig-iron, has remained pretty nearly constant for the last twenty or five-and-twenty years; while the works of Gartsherrie, Glengarnock, Ardeer, Calder, Coltness, and Summerlee, during that period, have disposed of their products at maximum prices, those of Lugar, Muirkirk, Kinneil, Castle Hill, Portland, Dalmellington, Devon, Almond, Lochgelly, Lumphinans, Gladsmuir, and Wishaw have only been able to obtain prices lower by 4*s*., 5*s*., or 6*s*. (sometimes even more), per ton; the other works not mentioned forming an intermediate class in price—and consequently in quality—between the two sets of works named.

On the other hand, if we look at the special requirements of the purposes to which Scotch pig-iron is applied, we find that the quality which above all others is sought for by consumers is *homogeneousness* or *constancy of grain and colour.* Foreign purchasers particularly, who value this iron for the large proportion of old castings which it will bear in second fusion, having once fixed these proportions, desire, above all things, to have no more experiments to make when they have to use new lots.

After this first quality, consumers require a *fusible* and *highly fluid* metal; and lastly, the Scotch pig-irons are esteemed for their *softness*, which makes them so suitable for turning, planing, and fitting, after casting.

Tenacity, which is the special characteristic sought for in certain iron works, particularly in the cold-blast works of England, has only a very secondary importance here.

In respect of the qualities of *homogeneousness* and *constancy* in the iron, it may be asked how is it that all the Scotch works do not produce results equally satisfactory? Is it due to the modes of working, or to the nature of the raw materials?

The modes of working, as we have seen, are very nearly uniform in the Scotch ironworks. We do not find here, as in some other districts of the United Kingdom, certain establishments which, in order to preserve a long-established reputation of their products, systematically reject any modification in their modes of working, which they pursue at the present day as at the beginning of the century. In Scotland, on the contrary, the works highest in repute for quality, adopt, like the others—and sometimes even before the others—any changes which appear capable of improving the economical conditions of manufacture.

To these changes—at least to some of them—are certainly to be attributed the ascertained falling-off, during the period 1850-58, in the proportions of Nos. 1 and 2 obtained from the consumption of the same qualities of raw material. The table we have given showing this falling off,* is in fact, taken from the books of one of the works highest in repute, at the present time as formerly, for the homogeneousness and constancy of its products.

That is to say, the influence which the variation in the modes of working would exercise on the quality in question, is insufficient to account for the differences we observe in this respect between the various Scotch works.

It is, therefore, among the raw materials that we must look for the causes of these differences. The constancy of grain and colour supposes a perfect uniformity in the action of the furnace; it particularly supposes the almost complete reduction of the ore before its arrival in the lower regions, and the maintenance of a steady temperature at the level of the twyers.

Now the table above referred to shows how regular, both in riches and composition are the Scotch ores, at least in certain works, since the quantity of iron obtained and the proportion of limestone used have remained practically unaltered during a period of sixteen years in the works from which the particulars given were derived.

On the other hand, as we have already said, the reductibility of the roasted blackbands is really excessive; and it is to this great reductibility, as well as the *slow descent of the charges*, that, notwithstanding their riches, these ores owe their capacity of producing "grey" pig, contrary to the general rule by which the production of this class of product is held to require a poor and refractory bed.

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* See *ante*, p. 205.

The *Mushet Blackband*, whose percentage after roasting varies between 55 and 60 per cent.—falling rarely to 45—with its great solidity and reductibility, has also been, particularly since the introduction of hot air, an ore admirably fitted for the regular production of products of the required quality. As a matter of fact, the works having the highest reputation in this respect are those which, up to the present time, have always had the largest supplies of this kind of ore. By a happy coincidence these works also possessed the finest supplies of the hard, solid and comparatively clean coal—such as the various varieties of the Splint Coal.

Some ironworks which had not the resource of an exclusive supply of the Mushet Blackband, succeeded nevertheless in maintaining a good position by the use of mixtures of other blackbands with argillaceous ores (claybands). But under these conditions, the regularity of the working was assured by the nature of these latter ores, which, as will be seen by analyses Nos. 9, 10, 11 and 12, were exceptionally rich.*

On the contrary, furnaces which had only mediocre ores available, like those corresponding to analyses Nos. 2, 3, and 4;† or which had only inferior coals available for smelting their richer ores, that thus required 30 or 35 per cent. of limestone—and that sometimes of inferior quality—were never able to return but irregular products. These poor and irregular ores had often besides the extra disadvantage of being the most siliceous and sulphurous, and possibly also, containing the least manganese and the most phosphorus; that is, in a word, were of such a nature as to leave the maximum of impurities in the metal, and to minimise those other qualities most required in Scotch pig-iron.

As to these other qualities, there is certainly by no means a perfect equality between all the pig-iron of Scotland, but they are generally *very fusible* and *very fluid*. Another pretty constant characteristic, is their *softness* and *slight tenacity*.

These characteristics have often been attributed, *en bloc*, to the presence of phosphorus in the Scotch ores, whether black or claybands. Without wishing to deny that a part of them may be due to an element which certainly exists in the greater number of Scotch ores in greater or less quantity, we still think, judging from the analyses already given of ores and pig-iron, that silicium and probably the earthy metals play a much more important part than phosphorus in the composition of the latter, and that consequently they probably influence their quality considerably more.‡

Notwithstanding the extraordinary basic nature of the slags, and

* See *ante*, p. 202. † See *ante*, p. 200.

‡ Aluminium is more abundant in pig-iron than is generally supposed, and the slight tenacity of the Scotch pig may well be partly due to the presence of this element. It has rarely been quantitatively ascertained, indeed by the ordinary modes of analysis the alumina necessarily remains mixed with the iron and the silica: thus, Karsten found little aluminium in pig-iron. But Truran, following Thompson, gives instances of various English irons containing from 0·5 to 1·0 per cent. of aluminium, and we know that some Swedish pig-iron contains 1·5 per cent. of calcium and magnesium, and 0·75 per cent. of aluminium.—Durocher, *Ann. des Mines*, 6, ix, p. 475.

the presence of manganese in greater quantities than is generally supposed, the proportion of silicium in Scotch pig-iron rarely falls below from 2 to 2·5 per cent. It seems sometimes greater than the percentage of carbon, while the proportion of phosphorus rarely exceeds from 0·5 to 0·6 per cent. It seems therefore that here, as in many other instances where gray-pig is produced with a hot working, that silicium is a constituent element of the pig-iron in the same sense as carbon.

Now nothing that we know at present of the alloys of iron, silicium, carbon and phosphorus, invalidates the hypothesis, that the first-named metalloid may be susceptible of communicating to the iron a *fluidity* and even a *fusibility* as great as those which may result from the presence of a few hundredth parts of the second or a few thousandth parts of the third. Indeed we know positively that highly silicious pig-iron is always, not only very fusible and very fluid, but also very soft: which are all characteristics of Scotch foundry pig.

On the other hand everyone now knows that the want of tenacity of hot-blast pig-iron is due to the excess of silicium which the high temperature of the lower regions of the blast-furnace, and a more complete reduction of the ores, causes to pass into the metal.*

* Having had occasion to communicate these views to M. Janoyer, Engineer-Director of the Iron Works of Vierzon, who has much to do with silicious pig-iron, we have received from him the following facts:—

In October, 1848, at the Horme works, working with a bed composed of—

		Oxygen calculated.	Formula.
Silica ..	.. 41·50	31·559	$B^5 S^6$.
Alumina ..	.. 10·00	18·292	
Lime ..	.. 48·50		
	100·00		

The iron obtained was a first-class foundry-pig—warm, fluid, and with little graphite. It possessed great tenacity, was hard, and showed a fine granular structure. In December of the same year, reasons of economy obliged a modification of the charge, and the introduction of an ore containing as much as 36 per cent. of quartzose sand, which gave a much more acid slag, composed as follows:—

		Oxygen calculated.	Formula.
Silica ..	.. 50·00	31·559	$B^5 S^9$.
Alumina ..	.. 10·00	18·292	
Lime ..	.. 40·00		
	100·00		

The other conditions of working being the same, the iron obtained now had lost much of the qualities which characterised the first. It was still warm and very fluid, and apt for thin castings, but which had a dull ring, and broke with the very least blow, showing a fracture like porcelain: there was no trace of graphite, and the product seemed to be more a silicuret than a carburet of iron, for it gave on analysis from 7 to 9 per cent. of silicium. Its most remarkable property was its *softness*—yielding to the knife. As foundry-pig it was detestable, and it was well known that to prevent its production it sufficed to increase the proportion of limestone. In remarking on the absence of graphite M. Janoyer does not mention the total proportion of carbon contained in this product; it was probably small, assimilating to analyses 19 and 20. (See *ante* p. 206.)

In a word, if it is to the nature of the raw materials that we particularly owe the *constancy* and *homogeneousness* of the Scotch pig, it is partly to the mode of manufacture that we must attribute its *fusibility*, *softness*, and *slight tenacity*.*

Among the elements whose presence is to be feared in the raw materials, sulphur is certainly the most injurious to the fluidity of foundry-pig: now it exists in sufficiently considerable quantities in the ores and combustibles of Scotland for us to expect to find it more abundantly than we do in the pig. But we have already shown, in the analyses of slags and pig-iron, the purifying influence which in this respect we must attribute to the basic nature of the former, and their high percentage of manganese.

We have said that *tenacity* was the last quality required in Scotch pig-iron. We may add, however, that even in this respect, the produce of various works are not identical, particularly after second fusion. Now from certain researches and studies recently undertaken on the re-actions of the refinery, particularly by each of us,† we know that, during the fusion, the silicium disappears, and all the more in proportion to the quantity of manganese in the iron: the same may be said of the phosphorus. According to this, it seems to us that the best Scotch brands may owe their high character to a certain proportion of manganese capable of re-acting usefully on the tenacity of the re-fused product. This advantage is perhaps classed as secondary, but it is none the less important when Scotch pig-iron is employed for mechanical castings.

Now, it is necessary to repeat before concluding, that too great a percentage of pyrites—a smaller proportion of manganese—or a larger proportion of phosphoric acid or silicious gangue—in the ores, would doubtlessly produce pig-iron, perhaps always *very fusible* and *very soft*, but less perfectly fluid, and at the same time of an insufficient tenacity for the most common castings? The example of analyses Nos. 19 and 20,‡ and the note of M. Janoyer, abundantly prove this as to the influence of an excess of silica in the ores.

To sum up:—

It is to their raw material; that is to say—(1) ores of a high percentage and manganiferous, of an excessively regular composition and a perfect reductibility, with (2) combustibles hard and solid in

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* We have made this observation advisedly, for it may check the common belief that the Scotch ores are incapable of producing "strong" foundry-pig equal to that of certain English works. We are inclined to believe that with a less hot working, particularly with cold air, the Scotch ores would, for the greater part, yield equally good iron as the argillaceous carbonates (claybands) of Wales, Staffordshire, and Yorkshire—perhaps quite as generally phosphorus as the former. Independently of the examples which we could find in support of this opinion in the case of certain Welsh works using blackbands similar to those of Scotland, we could give the instance of the Carron works (Stirlingshire) which formerly produced pig iron for cannons of a high repute with raw materials such as are at present applied to the production of soft foundry-pig for second fusion of ordinary commercial brands.

† Réactions de l'affinage des fontes pour acier et pour fer, par M. Lan. *Annales des Mines*, 5, xv, p. 85.—Notes diverses concernant l'acier puddlé, &c., par M. Gruner. *Ibid*, p. 291.

‡ See *ante*, p. 206.

It is true, that either from a fear of injuring the iron produced by ores more silicious and less easily treated, or because the different destinations require in the products qualities, and especially tenacity, superior to those which characterise Scotch pig, nowhere has air been heated to such a high degree as in that country. Still, even with air heated to 350 or 400°, we can scarcely explain by the theories now generally admitted, of *Berthier*, *Ebelmen*, *Scheerer*, &c., on the use of hot air, a difference in the consumption of 40 per cent. and even more, between the working with cold air and with hot.

Struck with the improbability of this estimate, we have examined and compared the two parts of the *Voyage Métallurgique* which treat of the making of pig-iron in Scotland in 1828 and 1833. We have thus found that the authors of this work, as well, doubtless, as the Scotch makers themselves, preoccupied with the importance of the new discovery, have involuntarily passed over in silence a modification in the form of the blast-furnaces susceptible of producing a great part of the effects attributed wholly to hot air: we speak of the increased size of the blast-furnaces, and particularly the enlargement of the body and throat.

This is worth the trouble of demonstrating; and here are the facts.

In describing the blast-furnaces of Scotland in 1828, and after having given the old form, the authors of the *Voyage Métallurgique* add:—

"*This furnace is rather small; those being built now* (1828) *are of much larger dimensions.* (See figs. 2, 3, 4, 5 of the atlas of the *Voyage Métallurgique*, 2nd edition.)

The authors continue:—

"*It is proposed to build a second furnace of still larger dimensions.*"

Lastly, after having given some pages further on the blast-furnace, fig. 7 of their atlas, they say again:—

"*A new furnace* (fig. 8) *is being constructed of very much larger dimensions. Besides, the form which seems to have been introduced into Wales is being adopted, which consists in suppressing the hearth.*"

It is very evident from this, that 1828 was a period of transition, as regards the increase of the transversal dimensions of the body; and what it is important to observe, the authors themselves of the *Voyage Métallurgique* say, "*Scotland commences these changes in imitation of those already made in Wales.*"

Now Mr. Truran states, that in 1831, the only modification of form which had been proposed, enabled the blast-furnaces of Dowlais (Wales) to produce with cold air and coal, a ton of foundry-pig with the following consumption of fuel:—

		Tons.	Cwt.
Coal directly charging the blast-furnace	.. ..	2	10
Coal for the blowing machine	.. ..	0	10

Total, 3 tons, instead of 7 or 8 consumed in the old small blast-furnaces with coke.

We shall not follow Mr. Truran in the comparison which he makes between the Scotch and Welsh works; he seems to us to go too far in almost denying the economy of the use of hot air, because he does not sufficiently take into account the differences of compo-

sition which distinguish the coal of the two countries.* But the results we have just given suffice to show how much we must reduce the share of hot air in the 40 per cent. economy observed in Scotland, if. as we have just succeeded in showing, the authors of the *Voyage Métallurgique* have neglected the influence of change of form.

Now of the three Scotch works (Clyde, Calder, and Monkland) which they mention in their experiments on hot air, the authors of the *Voyage Métallurgique*, do not give the forms or dimensions of the blast-furnaces of any of them. They confine themselves to saying of Clyde:—

"*The blast-furnaces of these works have not undergone any modification since the introduction of hot air; they were in blast long before the adoption of the new method: one of them has been in action for seven years.*" "*Long before*" cannot go back before 1828 or 1829, when they wrote in 1833; besides, the one in blast for seven years, must certainly have increased in size from the mere working. As regards the Calder works, they give the working of the furnace No. 3 for the years 1829, 1831, and 1833; but is it certain that the form has not altered? The authors say nothing about this.

On the other hand, in that part of their work relating to the year 1828, all that they say of the dimensions or forms of Scotch furnaces, evidently refers to these same works, since they only mention having visited three, and all three near Glasgow; two of these works had, at this first date, respectively three or four blast-furnaces. In 1828, *Calder and Clyde* were the only works in the neighbourhood of Glasgow which had this extent. It was in these works, then, that the authors of the *Voyage Métallurgique* saw, in 1828, those enlarged blast-furnaces being erected, which were working with hot air in 1833; the number of furnaces having remained the same. Now the large bodied blast-furnaces commenced in 1828 could not be at work in 1829, but would certainly be so in 1833.

From these considerations it seems to us to result clearly, if not with absolute certainty, at least with the strongest presumption, that attributing exclusively the 40 per cent. economy of combustible in question to hot air was incorrect, by omitting the proportion attributable to the enlargement of the body since 1828, and to the proportionate increase of blast. In apportioning the total economy of 40 per cent. between the two modifications, the part of hot air is reduced to 20 per cent., that is to say, it becomes more proportionate to that obtained elsewhere, by the introduction of this method into the blast-furnaces with coke.†

* All through this, we invariably assume that, as in all Scotch works, the air had to be heated by special furnaces, as well as the boilers and blowing machines themselves. In this case the facility afforded for consuming the smalls instead of the large formerly used to charge the blast-furnace, in order to produce the heat now furnished by the air, constitutes itself an evident economy, less, however, than when the waste heat from the throat is utilised for this purpose.

† After the above was written we received from M. Bordet, manager of the works at *Châtillon* and *Commentry*, some particulars on blast-furnaces with charcoal, quite in accordance with this opinion. He says:—

"It was in 1840 and 1841 that the first attempts at the application of hot air to

In the foregoing we have spoken of the economy in combustible, attributed in 1833 to the application of hot air; but another effect of this application, which seems to us to have been also very much exaggerated, is the increase in production. We have seen that the documents inserted in the *Voyage Métallurgique* fix the increase in the weekly or daily production, realised by the substitution of raw coal and hot air for coke and cold air, at nearly 50 per cent., or at least 40 per cent. In considering that the substitution of coal for coke, although producing a certain economy in combustible, could not operate very actively in the production; we see that the increase of production of from 40 to 50 per cent. would be almost exclusively due to hot air.

Now, not only do we know of no other examples of like results, but also from whatever point of view we look at it, it is difficult to see in the heating of air any sufficient reason for such an estimate. To us this increase of production seems rather the effect and at the same time the proof of an enlargement in the body of the blast-furnaces. *This increase and the more energetic blast having coincided with the application of hot air, their effects have been passed over unperceived, and set down to the credit of the second innovation.*

Whatever may be the cause of the economy of combustible realised in Scotland from 1830 to 1835, it is not the less certain that in 1835, the blast-furnaces of this district, with enlarged bodies and throats, produced in 24 hours 8 to 10 tons of soft foundry-pig, with a consumption of from to 2 tons to 2 tons 8 cwt. of large coal for the blast-furnaces, and 19 cwt. of smalls for the boilers and hot air apparatus.

Arriving at more recent periods, if we compare the existing works with those of 1833, we shall at once obtain a result very remarkable, and at the same time one which might, and ought to have been, expected from the immense blast-furnaces latterly constructed.

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blast-furnaces with charcoal were made at Châtillonnais. The economy of combustible amounted to about 10 per cent., the furnaces having the following dimensions: height 30 to 34 feet, diameter of throat 2 feet 8 inches, of belly 7 feet 8 inches, at the level of the twyers 1 foot 5 inches, and scarcely any hearth.

In 1844, the form of the blast-furnace was modified by reducing the hearth to 2 feet 8 inches above the level of the twyers; but it was not successful, the furnaces thus modified gave much more black-pig than white, the latter being the only one sought after by the refiners and puddlers of the district. It was not till after four or five months working that the furnaces, having increased in size, began at last to act regularly. The old form was resumed in 1847 and 1848.

In 1851, after having established the good effects of large throats and bodies in the blast-furnaces with coke at Commentry and Montluçon, it occurred to me to adopt these advantages in the charcoal furnaces. I enlarged the throat of some of our blast-furnaces at Châtillonnais from 2 feet 8 inches to 4 feet 8 inches, without modifying the other dimensions.

The furnaces thus enlarged gave all good results; the monthly production rose from 100 to 110 and 120, and even in one of them reached 145 tons; the economy of combustible being about equal to that first obtained in the application of hot air—that is, 10 per cent.

I may add a remark of importance as regards the enlargement of the throat and of the body. When first working, the furnaces thus enlarged were all subject to frequent explosions. I attribute this effect to having used the old quantity in the charges, in doubling them all inconveniences of this kind were avoided.

The direct consumption of combustible in the blast-furnaces, has scarcely, if at all, varied since 1833; the expenditure of smalls alone, for the boiler and hot air apparatus, has been reduced by about 50 per cent., and this under the influence of the establishment of better arranged hot air apparatus and boilers, motive power and blowing engines. The ores and combustibles have not otherwise varied to any great degree in the works to which our estimates refer.

What are we to conclude from this, except that the considerable enlargements, *particularly towards the lower part*, which have taken place in blast-furnaces during 25 years, have produced a great economy in combustible? The advantage consists in a more increased production, which in its various enlargements has besides always remained proportionate to the quantities of air thrown into these enormous furnaces and the capacities of the latter.

But if the consumption of coal does not seem to have notably varied compared with the ton of pig, we shall find on the contrary that it has increased a little per ton in fluid matter (pig and slag). In 1833 only one ton of coal was consumed per ton of fluid matter, now at present the consumption is generally 1 ton 1½ cwt. to 1 ton 6 cwt., with, however, poorer ores. We have only found one establishment where the consumption was to be compared with that of 1833; now it is worthy of remark, that this example refers to that blast-furnace whose hearth has been least enlarged; the section of this blast-furnace showing only 6 feet at the level of the twyers, instead of 7 to 8 feet like the others. This furnace is also the one which has the least number of twyers.

Thus, then, the exaggerated enlargements of the *lower* transversal dimensions of blast-furnaces, to which, as we have said, must be attributed *the small proportion* of Nos. 1 and 2, obtained during the period from 1850 to 1858, have also incontestibly increased rather than reduced the consumption of combustible.

It is easy to understand, in fact, that the regularity of the action finds its principal obstacle in the enormous dimensions given to the diameter or to the sides of the hearth, notwithstanding the increased number of twyers. Independently of the extraordinary care required to keep in order these numerous twyers, it is difficult, even with great pressure, to force the air through an entire width of from 6 feet 8 inches to 8 feet 4 inches; the least obstruction at one part of the hearth diverts the current of air, carries the fire first on one side, then on the other, which almost immediately results in the production of Nos 3 and 4. Heated air, even very highly heated, is no longer a sufficient remedy for these causes of irregularity; very intense combustion is produced at a short distance from the nozzles; while the centre is cold, the sides are frequently heated to excess, and recourse must often be had to water sprinkled over the exterior covering of the hearth.

Besides, if we remember that the Scotch ores are exceptionally rich, fusible, and reductible, we shall acknowledge how much more disastrous the large dimensions of the hearths would be with the generality of the poorer and more refractory ores of the Continent.

If, lastly, we compare the quantities of fluid matters, and even the production obtained, per ton of coal and per day, from the large

Scotch works and with ores exceptionally easy, with those obtained, specially in some French blast-furnaces, from smaller crucibles and less advantageous ores, we shall be struck with the inferiority of the Scotch forms in this respect.

We are convinced, however much it may be advisable to adopt a form where the diameter of the hearth is fixed between 5 and 6 feet (according to the more or less refractory nature of the ores), and the capacity of the body increased to the highest possible maximum; that it will be as generally injurious to adopt a form where the increase (as in the Scotch works) is exclusively confined to the enlargement of the hearth. In modifying the form of their furnaces in the sense we indicate, it seems evident to us that the Scotch iron masters would produce at least as much, if not more than at present, but with a less consumption of combustible; better prepared charges might, with the same blast as now, be worked through quicker.

The utilisation of the gas and flames from the throat is little attended to in Scotland, notwithstanding the probable richness of these gases in combustible principles. The motive we have heard alleged for this neglect is, that the Scotch blast-furnaces have generally at their disposal, small coal at a low price, which have no other use than for the boilers and hot air apparatus. It is also alleged that the drawing off the gas hinders the working of these large furnaces: the attempts made in certain works from 1850 to 1858, have spread the deep-rooted belief, that the gas cannot be drawn off, even from a depth of 3½ feet to 5 feet, without reducing the production from 20 to 25 per cent., and without augmenting the consumption of combustible from 5 to 6 cwt. per ton of pig.

We have shown elsewhere,* that large furnaces and large throats entail some difficulties in the drawing off this gas; but we have also shown that these difficulties are far from being insurmountable. Now in Scotland, none of the arrangements required to overcome these difficulties, have been adopted; the drawing off of the gas without even completely closing the throat, without mechanical appliances, must lead to the results observed in the attempts we allude to.

The question is, will these efforts be resumed by more perfect methods, of which examples may be found in Wales itself? This is to be doubted as long as the small coal has not a sufficient commercial sale to cause a rise in the price.

Summing up what precedes on the operations of the Scotch works, as regards product and consumption, we see that—

1. The progress since 1833 has been very inconsiderable in this district, at least as regards economy of combustible.

2. Already at this date, the definitive success of hot air in the working with coal was established; at this period also the forms had been modified, as regards the increased capacity of the body, by the greater diameter of the throat and of the belly; but the good effects of these modifications had been passed over unperceived, being confounded with those attributed to hot air.

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* Messrs. Gruner and Lan refer to another part of their Memoir, in which they treat generally the form and dimensions of blast-furnaces, and of which we propose giving an abstract in a future number.

3. From 1845 to 1850, and above all from 1850 to 1858, blast-furnaces have been again enlarged, principally in the height and in the transversal dimensions of the lower portions. From this has resulted no economy of combustible but rather an increased consumption; the daily production has augmented, but a little at the expense of the quality of the pig, the proportion of Nos. 1 and 2 having certainly lowered lately. In reducing the labour and general expenses by the larger production which they induce, these large blast-furnaces do not constitute a real general progress, for their vast hearths might be disastrous in the case of ores more refractory than the calcined Scotch blackbands.

4. The methods of utilising the gas of blast-furnaces, notwithstanding its evident value in combustible principles, has not been and doubtless will not for some time be generally applied in Scotland.

Mineral and Geological Sketch of the Minera Mining Field.

DENBIGHSHIRE, NORTH WALES.

By George Darlington.

(*Continued from page* 211.)

If we examine the mineral character of the Old Vein, we shall find that there exists a marked difference between its eastern and western portions, the minerals which characterise deposits of ore in the one part being wanting on the other.

Near the Meadow, or extreme eastern, shaft in the upper levels, this vein occurs in black shales and slates belonging to the Lower Coal and Millstone Grit series, and is usually very poor; deeper, it intersects the Carboniferous Limestone, and becomes to some extent productive, but instead of lead deposits, we find the lode filled with large quantities of brown blende (frequently well crystallized). This ore is intermixed with pulverulent and massive quartz, and contains besides, many large stones of galena, so that it is expected that valuable deposits of ore will be found as the lode is wrought in depth. Proceeding westward, the vein keeps up its character as a large blende producing lode, containing occasional nests or pockets of galena: at a distance of about 150 fathoms from our starting point, we note a change creeping in, and find the upper measures, as far as the 100 yard level, fairly productive, but these were wrought during the latter part of the past century. A barren bar of ground then intervenes for a vertical extent of nearly 30 fathoms, below which productive measures are again found, zinc-blende still forming a large constituent of the lode. Still more westward, the Old Vein gradually alters, until at a further distance of 160 fathoms we find the ore with a matrix of siliceous limestone and quartz, the latter both hard crystalline and pulverulent: blende is, comparatively speaking, rare. From this point (Taylor's shaft) to Ellerton's shaft,

250 fathoms westward, is the principal seat of the present operations, and throughout the whole extent of this ground the Old Vein is, and has been, largely productive—the gangue offering in most instances, a pretty certain guarantee of the future yield of ore from the vein. The sandy pulverulent quartz already noticed, is sometimes found in considerable quantities, and is similar in physical appearance to fine crushed table salt, consisting of minute crystals of quartz, which under the microscope are often found terminated by pyramids at both ends. It is in this part of the mine, and indeed everywhere where it occurs, an unfailing promise of a rich ore deposit. In the western end of this run of ground, we find a new veinstone accompanying the bunches of lead; it is a soft black shale, but as it has been seldom seen without being immediately followed by a good deposit of lead ore, and is much intermixed with it, it seems to me to be entitled to be considered a part of the true gangue of the lode.

In the West End mines, the Old Vein, as well as the cross and caunter lodes which are found in this part of the Minera mines, has some shale, a little blende, and much calc spar, as its characteristic minerals. Quartz in quantity does not occur; and regarding the veins at this point generally, I should consider the principal veinstone to be calc spar, while the contents of the lodes are often intermixed with a limestone breccia, cemented by calc spar. This character is constant throughout the remaining portions of the veins as we trace them westward.

Besides the Old Vein, there is another lode in the sett, of extreme productiveness. This is called the "North Vein," in the East End mines, from its position to the northward of the Old Vein; and it is doubtless the same as that known in the West End mines as the "Red Vein," although from the absence of any communication between the two mines during the former workings, it was generally believed, until the North Vein was cut, that the Red Vein either gradually diminished to a mere string and got lost in the Coal measures, or that it took a warp and fell into the Old Vein in the so-considered barren piece of ground which, until a recent year, separated the East from the West End setts. Both theories have, however, fortunately proved to be erroneous. The North Vein is really the north-east boundary of the faulty strip of ground, which incloses within its limits the ore deposits of the Old and North Veins—the first forming the south-western, and the second the north-eastern faults, both combined making up the entire throw.

The North Vein has, like the Old Vein, a down throw to the north-east, but it is not nearly so great. Its throw, however, is constantly increasing as it courses eastward, while that of the Old Vein attains its maximum near Taylor's shaft; so that, as far as I can discover, it would appear that the North Vein ultimately attains approximately the same amount of dislocation as the Old Vein has at this point—while the latter diminishes to a heave of no great extent when fairly in the Coal measures. This point of ultimate transference is probably about two miles from Taylor's shaft. At this point these two faults are uncertain in their manner of existence; but that they do exist, and have a combined throw of at least 120 yards, is a fact

which admits of no dispute, for they are well known to form the channel of faulty ground which divides the Brymbo and Ruabon coal-fields, and which is known to course from Minera through Pentre Bychan. It is to be regretted that this is not noticed in the Geological Survey maps of the district, as it is a point of much importance; for the Brymbo Main Coal, near or a little to the east of Pentre Bychan, is probably at least 200 yards deep, while on the other side of the fault it does not, in a corresponding position, exceed 80 yards from the surface.

To the north-east of the North Vein, no drivages have been made; it is, however, probable, that the ground is much disturbed, the edges of the strata impinging against the vein, being broken and disturbed in a high degree. No regular coal has been noticed, only small altered lumps of carbonaceous mineral; but the strata, composed of shales and thin sandstones intermixed, the former preponderating, belong to the true coal series, the fossil flora of the series in this district, having probably all of its genera represented. Much of the shales evidence a sliding action, the peculiar faces termed "slickensides," being far from rare. The vertical thickness of these strata is not great at any point; and we find as we progress westward, that the Millstone Grit rapidly comes in, forming the surface rock near the Hydraulic shaft, where the western portion of the mine commences. The throw of the North Vein is here small; but the lode which is henceforth known as the Red Vein maintains a distinct heave of the strata varying from 120 to 40 feet while traversing the extreme extent of the Minera sett. In its whole course it does not appear, with one exception, to be crossed, fed, or intersected by any form of mineral deposit; and in many respects it has remarkable and characteristic differences compared with its companion vein.

Returning again to the eastern boundary of the sett, we will consider the mineral character of this powerful and rich ore-bearing vein; which, although I use the term vein in its ordinary acceptation, the reader will yet remember is really, as before stated, a true fault, forming the northern throw of a faulty channel of ground, separating the Coal and Millstone Grit measures from the Mountain Limestone. Beginning at the extreme eastern trial upon this Red or North Vein, near the Meadow shaft before mentioned, we see that the lode has entered the Lower Coal measures, where it appears to be split into several branches: these are found in black shales, and contain some large and beautiful irridescent cubes of galena, associated with crystallized transparent quartz, which frequently leave pseudomorphous impressions. Much of the orey portion of the vein is extremely cavernous; but as it is not productive at this point to any marked extent, and is of recent discovery, the operations have been rather limited. It is at this Meadow shaft, that we find the Marion string (really a powerful deposit) crossing from the Old to the North Vein. Westward from this, nothing has yet been seen of the lode for upwards of 800 yards.

Passing the whole of the ground lying between Taylor's and Andrew's shafts, which on the Old Vein has been so productive, we reach (at the latter shaft) the point where the North Vein was seen for the first time. It will be remembered that the Old Vein at this

point was but slightly productive at the 150 and 170 yard levels, but that further west its character underwent a favourable change; in a similar manner the North Vein which, while in the ground near the shaft was but moderately productive, has been found, when followed westward, to yield large returns of ore. Some of the bunches of galena found here have been of extraordinary size, so that it has not been rare to see single parcels of vein-stuff, 60 tons in weight, drawn from these workings, not containing more than 15 per cent. of foreign matter. This deposit of ore extended as high as the 100 yard level, and has been quite as productive in its upper as in its lower zones: westward, the termination of the orey portion of the vein has not yet been arrived at, and, as far as the depth of the present workings has gone, the lode does not appear to have deteriorated in value to any extent, for it is still highly remunerative.

The character of the ore and its associated minerals here differs in some respects from those which we have observed at a corresponding point in the Old Vein. The ore is frequently fine grained, "steely," and but little large cubic galena has been found; but, although it appears argentiferous, it does not contain beyond the usual quantity of from 3 to 4 ozs. of silver per ton. The associated mineral is usually blende, and there is but little of any other. The walls, or lateral limits, of the vein are very ill-defined, and frequently cannot be said to exist with any regularity whatever: some shale occurs intermingled with the ore, and the adjacent strata are hard slaty shales, and black silico-calcareous rocks. They are usually very dry, and frequently absorb much moisture after exposure to the atmosphere for a few months, in which case they shale off in considerable masses.

At the Hydraulic shaft the vein has been seen at the 60 yard level, but is poor: it presents almost the same appearance as near Andrew's shaft, with the exception that it contains but little ore. What it may make at deeper levels is yet uncertain, but there is a probability of success. Further westward, there is a long stretch of ground in which but little has been done on the Red Vein; but what has been done has not been wholly unsuccessful. There seems to be no communication between the Red Vein and those portions of the Old and other veins which have formed the network of lodes near Royle's shaft.

In the neighbourhood of Andrew's shaft we observe the "parallelism of veins" distinctly exemplified in the large measure of metalliferous wealth stored up in the same belt of ground; westward, however, this is altered.

At Maes-y-ffynnon we find the lode absolutely poor, the very picture of worthlessness—a mere fissure in the strata, and free from even a moderate quantity of vein-stone or gangue: nor is it even a feeder to "flats" or "pipes" as other veins are. It has, at a previous period, brought much water along its course, but this now finds its way through other channels. The cheeks of the vein here consist of the bottom measures of limestone, with (at the surface on the downthrow side) some Millstone Grit; and the whole is unbottomed at the depth of about 100 yards by the Silurian rocks. Viewing the character of the vein at this point, and the nature of the ground

through which it henceforth courses, it would appear hopeless to expect any profitable returns of ore further west.

In addition to the Minera mines the following setts are being at present wrought in the same field:—Park, Pool Park, South Minera, Minera Union, Central Minera and North Minera; besides some small private adventures of limited extent worked generally in small portions of ground lying between the irregular boundaries of the other setts.

The Park mines both from their extent and position occupy the second most important place in the district. Situate to the west and south-west of the Minera mines they are necessarily wrought upon veins entirely distinct from those occurring in Minera; there is, however, one exception to this in the case of the "Ragman" Vein, which coursing caunter to the lodes both of Minera and the Park traverses the eastern portion of the latter sett.

The Park mine has been wrought through an extended period and with much success; latterly however the workings, though comparatively speaking shallow, have been frequently inundated with water; and a state of things precisely similar to that which existed in the Minera mines from 1816 to 1824, has frustrated all recent efforts at sinking the mine deeper, or working to a profit the orey ground already discovered.*

The surface of the Park mine lies at an elevation of from 300 to 500 feet above the level of the railway at Minera, which corresponds very nearly with the back of the Old Vein; and if, for the sake of more easily considering the relation between the two mines, we imagine the downthrow action of the Minera Old Vein to be removed, and the strata restored to their original position, we shall find the surface to lie, as nearly as possible, in a plane rising evenly towards the south-west until a line approximately corresponding to the south-west boundary of the Park mine is reached, from whence the surface undulates for some miles. The Park veins then are parallel to those of Minera, and traverse the same strata as the veins of the West End mines. Their characteristics, however, are more regular, as we should naturally expect by observing the gradual change which the veins in the West End mines undergo both in their progress to the north-west and in their extension to the south-west. In remarking, however, that the Park veins are more regular than those of Minera, I do not intend to convey the impression that they course more regularly, or have more distinct walls, or more regular dip, or other characteristics of the lodes of the West of England—although this impression would be in a great measure true—but I mean that they come nearer to our idea of a vein as derived from our experience of the other lead mines in the North Wales Mining district.

The Park mine has been chiefly wrought upon one vein which courses about north-west by west, and underlies pretty regularly at about 15° from the perpendicular: an underlie, however, which is occasionally broken by shale beds. The limestone traversed belongs

* This, as seen by the statement in our last number (p. 235), will be remedied by the new day level that is being brought up from Minera.—Ed.

to the middle and lower beds, and is almost always hard and compact, in colour passing from white to grey and light brown; the latter variety is, however, rare, the vein usually becoming worthless in such strata. The beds of limestone are moderately thick, and are not unfrequently parted by thin argillaceous bands. The vein is very open in structure, and there are many cavities in it and in the limestone adjacent; indeed the general character of the strata in the Park mine, and the portion of country lying beyond its western limits, strongly suggests the idea of great infiltrative action having taken place throughout the whole of the measures.

Besides this one worked on, there are some other veins occurring in the Park sett, but they appear to be branches from the main lode; and here again we note the similarity between the parallel veins in the West End mine at Minera, which were found to bifurcate and split as they went westward. Such is also the case in the Park mine, where their main lode forms four distinct branches in the western limits. It remains, however, to be yet proved if the analogy between the two mines can be carried further. The flats and dry feeder veins before noticed are, as far as we yet know, non-existent either in Park mines or immediately westward. This point is, however, by no means well determined, since the trials in the portion of ground where such mineral deposits might be expected to be found have been hitherto extremely limited.

The veins in the Park sett are chiefly composed of lead ore, calamine, and calcareous spar; quartz, blende, and clay occurring in minor quantities. Much carbonate of zinc has been from time to time found in the lode, and it seems to take the place of the blende so plentifully occurring in Minera. Its existence in the upper levels is considered a good prognostic of deposits of lead at greater depths.

Adjoining Park lies the Pool Park mine, from whence much lead ore has been obtained and considerable profits realised. The vein here seems to be intimately related to the Park main vein, and has a character somewhat similar; the ore, however, has occurred in much more irregular masses, and, if I am correctly informed, has been sometimes found in pipe or pillar deposits of great purity and richness. The vein is in limestone, but is not far distant from the outcropping of the Devonian series which has an existence in this neighbourhood; hence the thickness of the productive measures cannot be great, say from 400 to 500 feet. The limestone is hard, crystalline, and white, and is more or less siliceous; and the gangue associated with the lead ore consists chiefly of sand, clay, and fine breccia of limestone, with much muddy material: calc-spar is not abundant.

At no great distance from Pool Park the Devonian rocks crop out. The series here is very thin, but the measures increase in thickness as they go south-west. The works are not in any place known to be metalliferous, but it is believed that the veins are traceable through them, which is not the case in the Silurian rocks.

In glancing at the portion of this mining field included in the South Minera sett we shall have to retrace our steps, for these workings are upon the extreme south-eastern limits of the veins antecedent to their being lost in the Millstone Grit and Coal measures. The veins are regular, and course for long distances both through

the Limestone and Millstone Grit. They are usually open in their structure and are not unlike many of the Flintshire lodes.

The sett termed Minera Union is a small piece of ground situated to the west and north of the Maesyffynnon shaft at Minera. It is traversed by the Red Vein and by some of the lodes found in the West End mines. The position of the ground forming this sett is on the north-western outcrop of the Mountain Limestone; and the strata do not exceed on an average a thickness of 200 feet. The course of the Red Vein approximates to the limit of the sett, beyond which the downthrow of this fault brings the Millstone Grit on its hanging or north-eastern side. The Red Vein has not yet been seen in this sett, and consequently speculations as to its productiveness are necessarily uncertain. The other veins in the Union mine are characterised by a slight return in many mineralogical points to those of the central portion of Minera. Blende, and the black shale I have noticed, occur as the gangue of the principal lode, and the lead ore has been generally found associated with these minerals. The veins have been usually productive, and the measures, though thin, are regular and even in their character, possessing within a small extent, both laterally and vertically, most of the geological features of the district. They crop out in the eastern end of the next sett mentioned. Much of this limestone is burnt for lime, being free from foreign matter.

Central Minera lies to the westward of the Union mine, and occupies the last portion of outcropping thin limestone previous to the occurrence of the "Great Denbighshire Fault." The veins are characterised by many irregularities, nevertheless, one or two fine bunches of lead have been found in connection with them. The Ragman Vein, about which little has been said but which is perhaps the most marked, but poorest, vein in the entire district, cuts into this sett, but is not known to be productive, unless we consider the branches and veins in which ore has been found to be part of this lode; it is probable that they are offshoots from it. It is somewhat strange that a powerful vein like the Ragman, which is traceable for two miles and is the most regular lode in the entire district, should be so poor; yet it is certain, that it has hitherto failed in any way to repay working costs, although good bunches of lead have been occasionally found in connection with it. The Ragman is caunter to every vein in the entire district, coursing almost north and south: it passes through Central Minera, the extreme west end of Minera, through the Park, and probably through the South Minera mines, everywhere shifting and altering all veins which it may meet with. Its strike, underlie, thickness, and mineral contents, are all remarkably uniform; while its general poverty is equally so—its contents being chiefly sand, clay, and matter eroded from the surrounding rocks, and carried by water into the vein, through the numerous fissures and cavernous-like watercourses which exist in the Mountain Limestone on its western outcrop.

The mineral matter associated with the veins in Central Minera, deserves no particular notice. Blende, calamine, calc spar, and quartz, occur in limited quantities, which from the open communication existing between the veins and the country, we should naturally

expect to be the case: the rush of water through the whole, being far too rapid to allow of the quiet crystallizing out of such minerals. The Silurian slates unbottom this sett at an extremely moderate depth, and in its western extent these rocks are at surface.

With the extreme outlying portion of the district occupied by the North Minera sett I shall conclude the enumeration of the mines in this field. This sett occupies a set of limestone beds capped by Millstone Grit often a quartzite, and bordered by the Great Denbighshire Fault, which courses through the bottom of the romantic Nantyffrith valley, and upon the edge of which the North Minera workings are situated. The measures are distinctly different from those of Minera; for they form one of the detached portions of limestone (of which there are several) separated by the Great Fault from the main Flintshire series of beds. This little field is not traversed by any master lodes, but, as will be noticed by reference to the Geological Survey maps, by a series of smaller veins, in which occasionally deposits of ore have been found. These veins form a reticulation almost equal to that known by the Germans as a "Stockwerk," except that of course the scale of the North Minera veins is greater. Vein stone and gangue are of comparatively rare occurrence.

The causes of the enrichment of the veins at Minera do not appear very distinctly. A change of underlie, or the falling in of a branch or feeder from the south, often produces a bunch of ore; while it is quite certain that lead in large quantities is always associated with certain of the strata and follows them in their easterly dip. Again, the occurrence of a particular class of minerals in the vein, especially the pulverulent quartz and the black shale before referred to, are pretty certain indications of wealth; in some places calamine in the upper part of the lode is found to be a satisfactory promise of much lead ore in depth, while the existence of blende under similar circumstances is an unvariable guide to wealth.

The true minerals which are associated with the veins of the Minera field have been already enumerated. Calc-spar occurs remarkably well and largely crystallized, the usual form being six-sided prisms surmounted by three-sided pyramids—but it occurs in every known form. Quartz well crystallized in the usual hexagonal prism and pyramid, and blende in indistinct octahedra, and distinct rhombic dodecahedra with curved faces, are the chief minerals, besides galena which shows the usual forms derived from the cube. I must not omit to note the occurrence of anthracite coal (and there is no anthracite coal in North Wales) deep buried in some rich mass of lead ore. The laws of deposition from solution are remarkably well exemplified, and the "vughs" or cavities in the lodes exhibit fine specimens of the order in which the various minerals found in the veins have been deposited. I give an ordinary section of some of these specimens, commencing with the crust nearest the walls of the vein :—

From the Meadow Shaft Minera.	From Andrew's Shaft Minera.
Limestone,	Limestone
Quartz,	Blende,
Galena,	Quartz,
Blende,	Galena,
Calc-spar,	Calc-spar,
Copper pyrites,	Blende,
Iron pyrites,	Quartz,
Calc-spar,	Calc-spar,
	Copper pyrites.

The age of the formation of the lodes, appears to be almost (with the exception of the Ragman Vein) contemporaneous. That this had existence subsequent to the deposition of the coal strata is evident, for the Minera veins which are co-existent with the rest breaks through the Coal measures as faults, as we have seen. I do not think that they had their origin subsequent to the deposition of the Lower Permian series, for I can find no evidence to show that they have entered, disturbed, or altered the arrangement of these rocks, which lie comformably upon the coal series. Should this inference be correct, then the date of the formation of these lodes would be contemporary with the deposition of the upper coal strata. The Ragman vein has, however, been formed at a subsequent period, for it entirely breaks through the whole of those which in its course it intersects, and shifts each of them a certain distance.

The Seton Mining District.

By the Editor.

On a former occasion (Vol. I, p. 384) I referred to the great metallic mining district of Illogan and Camborne, made up of a series of lodes coursing nearly east and west at the foot and to the north of the granite range of Carn Brea, Carn Tregajorran, Carn Arthen, and Carn Entral. I showed that these lodes might conveniently, although probably rather arbitrarily, be divided into four zones—each successively receding further from the granite as we proceeded northward. It is with the western part of the northernmost of these zones—forming the Seton range—that we have at present to deal.

Of the run of lodes forming the Seton range of mines one stands out pre-eminent in importance. It is called the Great or North Caunter, and is a western continuation of Reeve's lode already described in a notice of North Crofty mine,* and which is there stated to be a strong caunter† bearing W. 25° N. From North Crofty (formerly called East Crofty), this lode in its western course

* See *ante*, p. 74.

† A "caunter" lode is one whose bearing makes a considerable angle, but one not exceeding 45°, with the normal bearing of the lodes of the district, whatever that may be. If the angle exceeds 45°, the lode becomes not a "caunter" but a "cross" lode. Some writers of the last century, with the characteristic pedantry of the age, substituted the word "*contra*" for caunter, assuming the latter to be a

passes through the cross course that forms the boundary of the setts, and enters the old Wheal Crofty mine, now forming the northern part of North Roskear sett, through which it approximately continues the same course for about 180 fathoms, into Wheal Seton sett. In this latter sett, a short distance from the boundary, it encounters the Great Cross-course, which heaves it from 20 to 25 fathoms to the right, but without altering its course. This still continues on an average to bear about W. 25° N., for another 130 fathoms, when (in the western part of Wheal Seton sett), it gradually changes its course by turning southward (to the left). It continues thus turning south for about 40 fathoms, and is at length found to have altered fully 36°—the bearing of the lode, towards West Seton boundary, being W. from 11° to 12° S. This new direction, which is about the normal bearing of the lodes of the district, continues without material alteration through the whole of West Seton into New Seton, and as far as seen in the latter sett.

For this entire extent, from the old Pool mine at Pool village, in the extreme eastern part of North Crofty sett adjoining East Pool, through North Crofty, Wheal Crofty, Wheal Seton, and West Seton, this lode has proved one of the most productive in Cornwall; and recent discoveries in New Seton, still further west, and in North Crofty and Wheal Seton, in depth, seem to show that we have not yet got to the extent of its resources either in length or downwards. A longitudinal section of the workings on this lode in Wheal Crofty, Wheal Seton, West Seton, and New Seton is given in Fig. 1, Plate II; if the reader will add to this the section of Reeve's lode at North Crofty given at p. 75, he will have a complete view of the workings from old Pool mine to New Seton—a distance of 1,300 fathoms or about a mile and a-half.

Although Wheal Crofty is scarcely reckoned popularly as belonging to the Seton run, yet as it is on the same lodes, and as the same great course of ore extended from it into Wheal Seton, it will be convenient shortly to notice it. It is a very ancient mine, so much so that its earliest workings seem lost in obscurity, but within modern times it has also made great profits, particularly from the Caunter, which was neglected by the old men.

Besides the Great Caunter, here called the North Caunter, there are five other productive lodes in this mine—the Engine lode, the North lode, the South Branch, the South Caunter and the South lode. The Engine lode bears about E. and W., and the engine shaft which is sunk perpendicular to the bottom of the mine (the 160) intersects it at the 20, at which point it is about 50 fathoms south of the North Caunter, although of course from their different bearings they come together going east. This engine lode made a bunch of ore shallow, which was wrought by the old men to the depth of 24 fathoms below the present adit.

The North lode lies to the north of the North Caunter in the

corruption of the former. There is not a particle of evidence in support of this view, and much might be said against it; besides "caunter" has a meaning quite distinct from "cross." It can also be conveniently used as a verb, for we can say such and such a lode "caunts" another at an angle of so many degrees.

eastern part of the mine, but coming westward they form a junction about 60 fathoms from Wheal Seton boundary. Westward of this junction the caunter made its richest courses of ore; and at the present workings in the bottom of the mine the tin makes best at the point of junction, which hades west 10 fathoms from the 44 to the 125.

The South Branch, which makes a few fathoms south of the North Caunter in the western part of the mine, made a bunch of ore from the 44 to the 64 for 20 fathoms long: going east it falls into the Caunter about 20 fathoms east of the junction of the North lode.

The South Caunter, lying to the south of the Engine lode, runs nearly parallel with the North Caunter, and has been a rich lode having made a course of ore, for 100 fathoms long, from above adit to the 54, which was worked to the 18 by the old men: this lode continues westward into Wheal Seton. The South lode has never been rich, but it is a very pretty looking and regular lode, making small bunches—the kind of lodes we find in Devonshire.

The modern riches of this mine were, however, on the North Caunter, neglected by the old men, which from the 34 to the 80 made one of the best courses of ore ever met with in the district, for the length shown in the section, and which extended for a still greater length on the west of the cross-course into Wheal Seton. This lode has been worked entirely by cross-cuts from the engine shaft, from 50 to 70 fathoms south, the shallowest of which was the 44, below which they have been driving at all the levels shown in the section. It is remarkable with regard to this lode here, and the same also applies to the mines further west, that shallow it is a miserable-looking clayey string, yet it has given splendid results while the showy South lode has afforded nothing. The great course of ore was richest from the 44 to the 74.

Besides the great course of ore, it will be seen by the section that some eastern bunches were met with on the North Caunter, but these—and indeed all the copper deposits in this part of North Roskear—have been long since exhausted. This mine is now worked for tin, which is found, as shown in the section, making under the old rich copper deposits. The tin was first found a little under the 84, but as the depth increases the lode is found to improve materially, and there seems every prospect of this lode, and the North lode, making tin mines in depth: as already stated the best lode is found about the point of junction, which however with its western hade and the north underlie of the lode is rapidly dipping into Wheal Seton sett. Until recently the water has been in to 140, but this level (as at North Crofty under the same management) has recently been drained, the water being lifted by a 45′ wheel to the 120, where it goes back to Doctor's engine at North Roskear south mine.

Considering the size of this lode in the bottom levels, and its highly promising character for tin, there can be no second opinion as to the excellent prospects it holds forth of making a tin mine, of which it is now returning 10 or 12 tons a month. It is against this lode, as far as North Roskear adventurers are concerned, that in the western part of the sett—that is the west of the Red River—the North Caunter will dip into Mr. Seton's land at a depth varying from

150 to 180 fathoms, at the deepest. Eastward of the Red River, and on the North lode, which is also a very promising one for tin, there is unlimited scope. With regard to the Caunter it may be worth remarking that if it had continued its regular course eastward from Wheal Seton without being heaved by the Great Cross-course, the main portion of the great course of ore would have been in Mr. Seton's land: the 25 fathoms heave to the right by the cross-course throws the lode south into Wheal Crofty right land for half a score levels.

The position of Wheal Seton with regard to Wheal Crofty is sufficiently shown by Fig. 1. As there is no section, nor any plan whatever of the old upper workings, it is impossible to lay down accurately the limits of the great course of ore in this mine, but its extent is approximately shown in the section we give. By this it will be seen that it made from about the 40 to below the 110, extending from the boundary to about 20 fathoms west of Tilly's shaft, dipping 20 fathoms in this course. This is the extreme extent of the bunch, but the richest portion was more limited. It is explored by two shafts—Bull's and Tilly's. The former as shown in Fig. 2, was originally sunk to work Bull's lode—a lode found in the eastern part of the sett, but which, in consequence of its bearing (W. 15° S.), passes into North Roskear sett going west. Bull's lode becoming poor below the 80, and a rich course of ore being working on the North Caunter, the shaft was run off north, through the country, crossing the South Caunter, to cut this lode, on which it was continued to the 120.* Tilly's shaft, as may be seen from Fig. 3, was sunk vertical to the 80 (really 67 fathoms) below adit, under which it continues on the course of the lode to the 120; below this it is sunk in the country to the south of the North Caunter with a regular underlie of 2″ in a fathom to the present bottom.

Besides this great run of ore ground, other less important but still considerable bunches of copper have been met with on the North Caunter in this sett. The most noteworthy of these is a run of ore ground near the West Seton boundary, which in the 100 made worth 8 tons to the fathom, for 25 fathoms long and 5 fathoms up. This bunch is taken away up to the boundary at this level, where there is a lode standing worth 10 tons per fathom; in the 110, which is also near the boundary, and is now driving by 2 men at 7*l.* and 2*s.* 6*d.* tribute, there is a course of ore worth 7 tons per fathom. Above these levels this bunch of ore is now practically gone, for until the recent discoveries it was about the only ore ground in the mine on this lode; but this will no doubt again form an important point when the deeper levels are brought up

Leaving for the moment the workings on the North Caunter at and below the 130, now the most important part of the mine, I will first dispose of the other lodes. Those (above the 130), as will be seen by the cross-sections, Figs. 2 and 3, are the Middle lode and the South Caunter. The latter is probably the same as the lode of that name in Wheal Crofty, and continues its course until it drops in with the North Caunter near West Seton boundary; but it has

* This is counting from Tilly's shaft, for the 120 from it is holed to the 130 from Bull's.

only been particularly productive from the 110 to the 130, for about 40 fathoms in length opposite Tilly's shaft. In the 110 and 120 this ground is gone, but the 130 west, the only drivage on this lode, is still opening out ore, the lode in this end being worth 10*l.* per fathom: the 140 cross-cut south will intersect the lode at that level in about 12 fathoms more driving.

The Middle lode is not traceable in the eastern part of the sett, for it dies away about 30 fathoms east of Tilly's shaft. The ore ground on this lode most worthy of notice is a shoot which made from the 80 opposite Tilly's shaft to the 110 much further west, the ore shooting away very fast west. The 110 west is now driving by 6 men at 12*l.* and 2*s.* 6*d.* tribute on a lode worth from 4 to 5 tons per fathom; but it has been worth 8 or 9 tons.

Going westward both these lodes fall into the North Caunter in consequence of its change of course already referred to. This is best shown by the plan, Fig. 7, which shows the principal levels on the North Caunter between Tilly's shaft and West Seton boundary, and the course of the South Caunter and Middle lodes falling in with this North Caunter.

The important points of operation at present in Wheal Seton are in the bottom of the mine, in the 130 and 140 fathom levels about Tilly's shaft, where this lode after an interval of poverty has again become productive. The plan of these levels given in Fig. 6 will best explain these workings; indeed without a plan they would be quite unintelligible for they are rather complicated. As the shaft below the 120 went down in the country to the south of the lode the latter was cut in the 130 by a cross-cut. This level was extended east and west on the lode, without any good result for a considerable distance; but when it had been driven east about 28 fathoms a fine bunch of ore was discovered by cutting into the side of the lode at the point *d*. Further explorations showed that this ore made on a new lode branching off north from the main lode at this point, to which the name of the *North Part* has been given. From the point of junction *d*, a good course of ore, averaging from 4 to 5 tons per fathom, made back west on this North Part for 16 fathoms long, continuing up above the level about 5 fathoms high. In the heart of this bunch of ore the winze *b* has been sunk to the 140, and has turned out for the first 4 fathoms sinking from 4 to 5 tons per fathom, and below that 10 tons per fathom. Beyond the 16 fathoms rich run of ore-ground some ore has made all the way back on this north part, which has also been cut by a continuation north of the cross-cut *a* from the shaft. It is worth noticing of this level that about 12 fathoms east of the shaft a cross-cut was commenced to drive north at *c* and extended some little way but was suspended: if this had been continued driving the ore on the North Part would have been discovered long before. It will be remarked that coming west of the shaft the two parts of the lode are coming together again.

In driving the 130 west on the North Caunter a bunch of ore has been met with and passed through for 8 fathoms, worth from 2 to 4 tons, a continuation probably of the ore shown worked away in the level above. The lode in this end is now 18 inches wide and worth 2 tons per fathom.

In sinking from the 130 to the 140 a run of greenstone locally called "ironstone" was met with half-way between the two levels, as shown in Fig. 3, which seems to have had a striking effect in enriching the lodes, for while only the North Part was productive in the 130 both parts have been rich at the 140. The North Caunter was intersected at this level by a cross-cut from the shaft at the the point *l* (shown in Fig. 6), where it was found to be worth 4 tons per fathom: this continued to the first junction *e*, where the North Part was met with at this level, the point of junction having thus dipped about 18 fathoms. East of this junction (*e*) another still richer run of ore ground, worth 10 tons per fathom, has been passed through for 14 fathoms long, in which the rich winze *b* has come down from the 130. From the extent of this 14 fathoms to the present end the lode has yielded from 3 to 5 tons per fathom, the forebreast being now worth 3 tons, driving by 4 men at 13*l*. 10*s*. During the middle of October on cutting into the side of the level at the point (*f*), another part, which we may call the *New North Part*, has been found, 6 feet wide, producing 6 tons of copper ore per fathom, a good work for tin: whether this new part will make back west or not remains to be seen. Below the 140 the winze (*b*) is sunk 3 fathoms in a lode producing 10 tons per fathom, sinking by 6 men at 16*l*.

The 140 level west of junction on North Part (*g*) is worth from 4 to 5 tons per fathom, driving by 4 men at 10*l*. and 2*s*. 6*d*. tribute. From the point of junction (*e*) to the present end, this North Part has averaged from 3 to 5 tons per fathom. The 140 end west on the south part (*k*) is now poor, but a good lode made from the cross-cut averaging 3 tons for 12 fathoms long to within a short distance of the present end.

Besides the North Caunter in its various parts another new lode has been cut at the 140, about 7 fathoms to the *south* of the shaft, as shown in the cross-section Fig. 3. This is called the *New South lode*, and has not been seen in the 130, unless indeed it is represented at that level by a joint noticed in the plat. It has been opened on for about 20 fathoms long at the 140, and for nearly the whole of that distance has turned out on an average from 2 to 5 tons per fathom. Both ends are now suspended, the air being poor, but they had previously fallen off, the west end to 1 ton per fathom, and the east end to *nil*. A winze is however sinking 6 feet east of the cross-cut by 4 men at 7*l*. 10*s*. and 2*s*. 6*d*. tribute, on a lode which has been worth 8 to 9 tons per fathom (9 feet long), but is now worth but 6 tons. In the shaft itself, 2 fathoms below the 140, a branch (called *Tilley's lode*) has been met with and continued down to the 150 turning out 3 tons per fathom for the length of the shaft. As it has not been opened on it is difficult to say much about it. It will be seen that cross-cuts have now been commenced driving from the shaft north and south at the 150.

Where productive in these bottom levels the lode always contains considerable quantities of fluor-spar ("can"), and the ground is hard; where the ground becomes easier, or the can falls off, the lode is impoverished. All the 140 levels are in greenstone, and there undoubtedly seems to be some connection between this rock and

the enrichment of the various parts of the lode, although the North Part made productive at the 130 in the killas above this rock. In this part of the mine all the productive parts are in Mr. Pendarves' land, the ore just extending east to Mr. Seton's boundary but no further—the boundary winze coming down on the point of junction *d* at the 130. All the copper ore in these bottom levels seems to contain more or less tin.

It will be seen by the plan Fig. 7, that the lode in the western part of the mine comes in contact with an elvan course; and that where this occurs the lode changes its direction from its original caunter bearing into one parallel with the elvan course, with which it continues to run, at least as far as New Seton, a distance of 500 fathoms. Whether the elvan has caused this alteration in course it would be difficult to say, but the coincidence is worthy of notice. Going east the elvan and lode diverge, and opposite Tilly's shaft their relative positions are approximately shown in Fig. 8: at Bull's shaft the elvan has gone away far north of the lode.

The discovery of new bunches of ore in the bottom levels of this mine was a result scarcely expected. The occurrence of tin in the deeper levels of Wheal Crofty and Reeve's lodes at North Crofty rather led many to expect the same result in Wheal Seton. I believe myself that this copper is to be attributed in a great measure to the greenstone, in connection with which rock the great copper deposits of North Pool and the Tolgus mines have been met with, in about the same zone as the Seton mine, but further east. However this may be the discovery is one of considerable importance, for it shows that where the greenstone lies deep, as in this case, we may expect the lodes, when they come in contact with it to make new deposits of copper beneath the old ones.

Besides the run of lodes described there are several other northern lodes in this sett. Harvey's lode about 150 fathoms north; Cock's lode about 70 fathoms again north of this, which has been worked down to the 64; and Simmon's lode 60 or 70 fathoms again north. These are no doubt destined some day to make important mines, for lodes still further north, at Wheal Emily Henrietta, are now shown to be promising. Indeed Wheal Seton is altogether a mine of great resources, for we must not forget that the North Caunter at Wheal Crofty underlies into this sett west of the Red River, where there seems every prospect of a great tin mine in depth.

Until recently the working of the Wheal Seton was not for many years conducted with either the vigour or judgment characteristic of the district. If it had, the ore now working would have been discovered years ago. At present, however, tutwork is prosecuted with all prudent energy under the direction of Captain Robert Williams, manager, and Captain William Rowe. The purser, Mr. T. Harry Tilly of Falmouth, has been connected with the mine for many years. The present returns of Wheal Seton are about 3,000*l*. for 2 months, after paying dues, which leaves a profit of from 800*l*. to 1,000*l*.

The description of the remaining portion of the Seton district, including West Seton, New Seton, and South Seton, will be concluded in our next number.

WHEAL MARY ANN.—In our notice of this mine last month, we omitted to give the returns. These, from the commencement of the mine in 1846, to the end of 1861, amounted to 15,987 tons 12 cwt. 2 qrs. of lead ore, realising 322,913*l*. 16*s*. 4*d*., up to the 9th of September last. 57,728*l*. has been divided in profits, being 56*l*. 7*s*. 6*d*. per $\frac{1}{1024}$ share.

Abstracts and Reviews.

THE *ANNALES DES MINES*.

Annales des Mines, ou Recueil de Mémoires sur l'Exploitation des Mines, et sur les Sciences et les Arts qui s'y rapportent. Rédigées par les Ingénieurs des Mines, et publiées sous l'Autorisation du Ministre des Travaux Publics. Sixième Série. Tome I. 3e livraison de 1862. Paris: Dunoid, Quai des Augustins.

THE present number of the *Annales des Mines* contains:—

1. M. Moissenet's paper on the Mines and Smelting Works of Snailbeach, which we abstract elsewhere.

2. The continuation of MM. Gruner and Lan's memoirs on the Present State of the Metallurgy of Iron in England.

3. Recherches Théoriques sur les effets méchaniques de l'injecteur automoteur de Mr. Giffard, par M. Résal, ingénieur des mines.

3. Recherches expérimentales sur les propriétés physiques du jet de l'injecteur automoteur, par MM. Minary et H. Résal.

4. Note sur les petits chevaux alimentaires des bateaux-à-vapeur du Rhône, par M. Debette, ingénieur des mines.

5. Note sur les Pompes Gensoul, produisant l'élévation de l'eau par condensation de vapeur, par M. Debette.

6. Note sur l'explosion de la machine locomotive, No. 645, près de la station de Laybach (Sud-Autrichien).

The present part of MM. Gruner and Lan's memoir is devoted to Plates, Sheets and Rods, including bridge and tank-plates, boiler plates and corrugated plates, single, double, and lattens, black and tin-plates, cabel-iron, nail-rods, rivet-iron and wire. It is sufficient to say that these matters are treated with the same ability, and evidence the same careful research and really extraordinary amount of information, as the previous portions of their memoir. Some very valuable information is given on the manufacture of tin-plates, from which we find that the proportion of mills in South Wales and their production, compared with other parts of the kingdom, is as follows:—

		WALES.		
Carmarthenshire ..	8 mills	....	1,750	weekly production in boxes.
Glamorganshire ..	35 ,,	....	7,663	,, ,,
Monmouthshire ..	31 ,,	....	6,850	,, ,,
		ENGLAND.		
Gloucestershire ..	10 ,,	....	2,500	,, ,,
Worcestershire ..	8 ,,	....	1,950	,, ,,
Staffordshire ..	11 ,,	....	2,300	,, ,,
Lancashire.. ..	4 ,,	....	1,000	,, ,,

of which, out of a total of 107 mills, producing 23,900 boxes a week, the Principality contains 74 mills, producing 16,150 boxes, leaving only 33 mills, 7,750 boxes, for the rest of the kingdom. This gives a yearly production 1,300,000 boxes, and as each box weighs on an average about 1 cwt., we

have, in round numbers, a weekly yield of 1,200 tons, or an annual yield of 62,400 tons.

The other memoirs call for no particular remark beyond their titles which we have given. Appended to this *livraison*, we have a list of the *personnel* of the French Imperial *corps* of mines, a *corps*, which for general scientific attainments, certainly ranks above any other in Europe. It consists of 3 Inspectors-General of the 1st class, 6 Inspectors-General of the 2nd class, 21 Engineers-in-chief of the 1st class, 20 Engineers-in-chief of the 2nd class, 27 Ordinary Engineers of the 1st class, 41 Ordinary Engineers of the 2nd class, and 21 Ordinary Engineers of the 3rd class; there are besides, the Student Engineers (*Elève Ingénieur*). At the head of the list stands the renowned name of Elie de Beaumont, Grand Officer of the Legion of Honour, Senator, member of the Academy of Sciences, and senior Inspector-General of the 1st class. Monsieur de Beaumont is sixty-four years of age, and entered the *corps* in 1819; but, although at present at the head of the *corps*, there are three others, now his juniors in rank, who entered the service before him. The junior Inspector-General of the 1st class, is Monsieur Combes, Commander of the Legion of Honour, Director of the Imperial School of Mines, the well-known author of the *Traité de l'Exploitation des Mines;* M. Combes is sixty-one years of age, and entered the service in 1820.

Among names known in this country, we may mention M. Le Play, Commander of the Legion of Honour, who stands second on the list of Engineers-in-chief of the 1st class. Michel Chevalier, Grand Officer of the Legion of Honour, Senator, the well-known political economist, sixth on the list of Engineers-in-chief of the 1st class; M. Gruner, officer of the Legion of Honour, thirteenth on the list of Engineers-in-chief of the 1st class: Monsieur Daubrée, Officer of the Legion of Honour, fourth on the list of Engineers-in-chief of the 2nd class; Monsieurs Delesse and Rivot, Officers of the Legion of Honour, third and eleventh respectively, on the list of Ordinary Engineers of the 1st class; Monsieurs Lan, Beudant and Moissenet, tenth, fourteenth, and thirty-fourth respectively, on the list of Ordinary Engineers of the 2nd class. M. Michel Chevalier is fifty-six, and entered the service in 1825; M. Gruner is fifty-three, having entered the service in 1830; M. Daubrée is forty-eight, and entered the service in 1834; M. Delesse is forty-five, and entered the service 1839; M. Lan is thirty-six, having entered the service in 1847; while M. Moissenet is only thirty-one, and entered the service in 1853.

Besides the mines of the empire, the control and surveillance of all the railways are under the *corps* of Mining Engineers, associated with the Engineers *des Ponts et Chaussées*.

JURORS' REPORTS, INTERNATIONAL EXHIBITION, 1862.—CLASS I.

International Exhibition, Jurors' Reports, Class I. Mining, Quarrying, Metallurgy, and Mineral Products. Reporter, Warington W. Smyth, M.A., F.R.S., Sec. G.S., Professor of Mining at the Royal School of Mines, Inspector of Mines to the Crown and the Duchy of Cornwall. London: Bell and Daldy, for the Society or Arts.

Few of the results of the International Exhibition are more satisfactory than this Report on Class I, by Mr. Warington Smyth, for few among the Reporters were so specially fitted for the duty to be fulfilled, by a wide range of knowledge, acquired through many years of practical experience over a large portion of Europe, based on the solid foundation of a Cambridge education. Among those who can properly be said to belong to the scientific world, Mr. Smyth indeed stands alone, as possessing the entire confidence of the practical mining community, because he alone has deemed it worth his while to undergo the great—and not always agreeable—labour

necessary to acquire a sound practical knowledge of the subject; a knowledge which, no books or school can teach, and the absence of which, on the part of men who set up as teachers or expounders, is so painfully irritating to those who do possess it.

The extensive range of subjects included in this class, rendered it necessary to subdivide the whole into sections, and the following has been adopted:—

1. Geological and topographical maps and models, and general collections.
2. Non-metallic mineral substances, coal excepted.
3. Working of mines.
4. Coal and other mineral fuels.
5. Iron.
6. Metals other than iron.

As every paragraph in the Report is teeming with facts, it would be scarcely possible to give a notion of it in any abstract of moderate space; and as it is published for 1*s*., and consequently accessible to everyone, it is unnecessary to do so. As a record—as a succinct history—of the progress of the mineral and metallurgical industries of the world during late years, it should be in the hands of every one interested in them.

THE BOARD OF TRADE RETURNS.

The "Accounts relating to Trade and Navigation of the United Kingdom, for the month ended 31st August, 1862, and eight months ended 31st August, 1862," have been issued by the Statistical Department, Board of Trade.

Imports.—The imports of metals and metallic ores for the month and eight months ended 31st August, have been as follows:—

	Month ended 31st August.		Eight Months ended 31st August.	
	1861.	1862.	1861.	1862.
Copper Ore .. .. tons	8,561	5,322	48,748	57,412
Copper Regulus .. „	1,579	2,283	10,833	25,232
Copper, unwrought and part wrought	20,660	24,080	157,140	176,300
Iron, in Bars, unwrought tons	3,982	6,918	16,801	18,990
Steel, unwrought .. „	377	217	1,886	2,780
Lead, Pig and Sheet .. „	1,807	605	12,664	13,702
Spelter or Zinc.. .. „	2,258	1,812	14,133	9,991
Tin, in Blocks, Ingots, Bars, or Slabs .. .. cwts.	3,318	6,912	29,004	49,296
Silver Ore .. value in £	8,919	2,684	195,428	196,693
Quicksilver .. .. lbs.	84,404	500	1,289,511	125,254

Comparing the imports of these articles during 1861 and 1862, the only remarkable changes are—an *increase* in unwrought iron, in bars, of 2,936 tons during the month, and 2,189 tons during the eight months; in tin in blocks, of 3,594 cwts. during the month, and 20,292 cwts. during the eight months; and a *decrease* in quicksilver of 83,904 lbs. during the month, and 1,164,257 lbs. during the eight months. Copper ore and silver ore show a decrease during the month, but an increase during the eight months.

Exports.—The quantities and declared value of the exports of metals, minerals, and metallurgical articles of British and Irish produce and manufactures, for the month and eight months ended 31st August, have been as follows—

		QUANTITIES.				DECLARED VALUE.			
		Month ended 31st August.		Eight Months ended 31st August.		Month ended 31st August.		Eight Months ended 31st August.	
		1861.	1862.	1861.	1862.	1861.	1862.	1861.	1862.
						£	£	£	£
Alkali: Soda	cwt.	157,078	205,145	877,992	1,383,631	66,393	90,160	382,487	583,359
Coal, Cinders, and Culm	tons.	742,658	853,314	5,340,307	5,543,874	338,050	385,470	2,444,276	2,489,150
Iron, Pig and Puddled	"	32,705	39,631	262,672	306,833	87,598	105,222	703,332	820,360
Iron, bar, Angle, Bolt, and Rod	"	21,954	25,343	172,330	198,355	155,223	186,385	1,253,903	1,432,179
Railroad Iron, of all sorts..	"	37,160	38,424	278,611	271,332	278,259	289,053	2,131,136	1,889,641
Iron Wire	"	1,092	1,267	8,487	8,148	17,976	28,482	148,641	179,407
Iron, Cast	"	6,500	4,662	46,526	42,301	62,128	41,020	436,765	365,694
Iron Hoops, Sheets, and Boiler Plates ..	"	6,341	9,339	55,420	66,835	66,725	92,870	564,549	654,181
Iron, wrought, of all sorts	"	9,543	12,430	68,957	81,856	185,148	203,935	1,313,064	1,342,923
Iron Steel, unwrought	"	1,844	2,687	14,297	18,095	64,182	80,317	470,636	587,660
Copper, unwrought in Ingots, Cakes or Slabs	cwt.	11,223	12,447	64,443	68,784	51,064	58,902	320,534	336,467
Copper, wrought, or partly wrought, Bars, Rods, Bottoms, Pans, Plates, Sheets, and Nails; and mixed or Yellow Metal for Sheathing ..	"	32,566	39,352	201,293	273,134	149,465	187,232	966,542	1,278,508
Copper, wrought, of other sorts	"	5,075	2,448	28,302	16,770	28,867	13,888	162,808	101,557
Brass of all sorts	"	1,754	3,050	18,506	24,417	10,186	18,863	104,314	132,926
Lead, Pig, Rolled, Sheet, Piping, Tubing, and Lead Shot	tons	1,990	3,865	11,945	23,342	42,362	80,109	267,410	494,221
Lead Ore, Lead, Red and White and Litharge of Lead	"	669	558	3,832	5,879	16,567	14,012	98,990	131,678
Tin, unwrought	cwt.	5,814	8,219	37,509	57,408	34,500	45,528	229,594	332,690
Tin Plates	"	—	89,173	—	729,618	59,228	109,758	596,587	876,441
Zinc or Spelter, wrought or unwrought ..	"	10,158	5,626	62,906	61,562	9,294	5,880	69,665	60,944
Salt	tons	54,154	77,613	503,952	451,782	28,554	35,643	270,702	218,851

Comparing the value of the exports of these articles during 1861 and 1862, we have the following results:—

FOR THE MONTH ENDED 31ST AUGUST.—During this period of the present year, the total value of exports has been 2,072,729*l.* against 1,751,769*l.* during the corresponding period of 1861, showing a *nett increase* of 320,960*l.* On the separate articles enumerated, the respective increase and decrease has been has been as follows:—

Increase.—Alkali, 23,767*l.*; coal, cinders, and culm, 47,420*l.*; iron (pig and puddled), 17,624*l.*; iron (bars, &c.), 31,162*l.*; railroad iron, 10,794*l.*; iron wire, 10,506*l.*; iron hoops, sheets, &c., 26,145*l.*; iron (wrought), of all sorts, 18,787*l.*; iron steel (unwrought), 16,135*l.*; copper (unwrought), 7,838*l.*; copper (wrought or partly wrought), bars, &c., 37,767*l.*; brass, 8,677*l.*; lead, 37,747*l.*; tin (unwrought), 11,028; tin plates, 50,530*l.*; and salt, 7,089*l.* Making a total gross increase of 363,016*l.*

Decrease.—Iron (cast), 21,108*l.*; copper (wrought of other sorts), 14,979*l.*; lead ore, 2,555*l.*; and zinc or spelter, 3,414*l.* Showing a total gross decrease of 42,056*l.*

FOR THE EIGHT MONTHS ENDED 31ST AUGUST.—During this period of the present year, the total value of exports has been 14,308,837*l.*, against 12,935,935*l.*, during the corresponding period of 1861, showing a *nett increase* of 1,372,902*l.* On the separated articles enumerated, the respective increase and decrease has been as follows:—

Increase.—Alkali, 200,872*l.*; coal, cinders, and culm, 44,874*l.*; iron (pig and puddled), 117,028*l.*; iron (bars), 178,276*l.*; iron wire, 30,766*l.*; iron hoops, sheets, &c., 89,632*l.*; iron (wrought), of all sorts, 29,859*l.*; iron steel (unwrought), 117,024*l.*; copper (unwrought), 15,933*l.*; copper (wrought or partly wrought), bars, &c., 311,966*l.*; brass, 28,612*l.*; lead, 226,811*l.*; lead ore, 32,688; tin (unwrought), 103,096*l.*; and tin plates, 972,854. Showing a total gross increase of 1,087,291*l.*

Decrease.—Railroad iron, 241,495*l.*; iron (cast), 71,071*l.*; copper (wrought of other sorts), 61,251*l.*; zinc or spelter, 8,721*l.*; and salt, 51,851*l.* Showing a total gross decrease of 434,389*l.*

Comparing the value of the exports to various countries during the present and preceding years, of certain of the above articles, the following show the more remarkable fluctuations:—

France.—To this country, the increase in the value of the exports of certain articles, has been very striking, which is due to the effect of the Treaty of Commerce. Thus, alkali has increased from 6,501*l*, during the first eight months of 1861, to 29,647*l.* during the corresponding period of the present year. Pig-iron has increased from 191,943*l.*, to 326,189*l.*; iron bars from 68,826*l.* to 133,105*l.*, and wrought-iron (of all sorts), from 32,990*l.* to 52,678*l.*, during the same periods of 1861 and 1862 respectively. Railroad-iron, which advanced from 182*l.*, during the first eight months in 1860, to 39,925*l.* during the corresponding period of 1861, has now increased to 216,274*l.* during the same period of 1862; and wrought-copper has similarly increased (during the corresponding periods), from 3,174*l.* in 1860, to to 45,569*l.* in 1861, and 45,729*l.* in 1862.

United States.—To this country, there has been a remarkable decrease in the exports of most articles, with the exception of lead, which has increased from 1,451*l.*, during the first eight months of 1861, to 154,088*l.*, during the corresponding period of 1862. The principal decrease has been in pig-iron, which has declined, for 137,035*l.*, exported during the first eight months of 1860, to 78,706*l.*; 36,127*l.* during the corresponding periods of 1861 and 1862; and in railroad-iron, which has decreased from 579,090*l.*, during first eight months of 1860, to 164,919*l.* and 68,470*l.*, during corresponding periods of 1861 and 1862 respectively.

Sweden, Russia and Australia.—To these countries there has been a considerable alteration in the exports of railroad-iron. To Sweden, there

has been a steady increase of from 8,173*l.*, during the first eight months of 1860, to 64,523*l.* and 80,918*l.*, during the corresponding periods of 1861 and 1862 respectively. To Russia and Australia, there has been a decrease during the first eight months of the present year, compared with the corresponding period of 1861; to Russia, the decrease has been from 168,380*l.* to 63,890*l.*, and to Australia, from 143,724*l.* to 42,633*l.*

LEAD MINING AND SMELTING IN THE SNAILBEACH DISTRICT, SHROPSHIRE.

Traitement de la Galène au Four Gallois; Notice sur les Usines à Plomb de Pontesford près Shrewsbury, Shropshire; et Note sur la Fabrication du Minium à l'usine de Shrewsbury. Par M. L. Moissenet, Ingénieur des Mines. Paris: Dunod, Quai des Augustins.

M. Moissenet's name seems likely to become a "household word" in our English Mining districts. Cornwall is indebted to him for by far the most complete descriptive essays we possess on the Dressing of Tin Ores, and on the Man-engine; and before the appearance of Dr. Percy's Metallurgy, his memoir on the Cornish Method of Assaying Copper Ores was the best extant.

Having had occasion to visit several of the smelting-works of Flintshire, and, in the autumn of 1860, the smaller ones of Pontesford, near Shrewsbury, the author considered it would be advisable to give a succinct description of the latter, as from the limited scale on which they are conducted—compared with the great establishments in the neighbourhood of Holywell—and the price of fuel, they are more analogous in their conditions to those carried on in the various parts of France.

The lead district of the Shelve, to the south-west of Shrewsbury, is at present divided among three companies: that of Snailbeach, which is the most considerable, and those of Stiperstone and White-grit. The latter works the mines furthest from Shrewsbury; the two former have their smelting-works contiguous—situated at the foot of Pontesford-hill, at the entrance of the village of Pontesbury about 9 miles south-west of Shrewsbury.

The Snailbeach smelting works are supplied from the mine of the same name worked about 5 miles beyond Pontesbury. The neighbouring company is supplied from several smaller mines, worked together under the general name of the Stiperstone mines, at distances of from 8 to 9 miles from the works. The ore is carted to the works and from thence in pig to Shrewsbury where the whole of the produce of the Stiperstone mines, and a greater part of that of Snailbeach is absorbed by the works of Messrs. Burr, Brothers, in the manufacture of minium, sheet and pipe-lead, and shot. The lead only contains 2 ounces of silver per ton, but it is of extreme purity, specially fitting it for the manufacture of minium.

The lead district of the Shelve* skirts, on the west, the well-known quartzose ridge of the Stiperstones. This ridge ranging N.N.E. and S.S.W., constitutes as it were a divisionary band between the ferruginous unfossiliferous Cambrian greywacke of the Longmynd, with its copper veins (on the E.S.E.) and the lead-bearing, fossiliferous Lower Silurian grits and shales of the Shelve (on the W.N.W).

The most important mine at present worked in this district, is Snailbeach, which is likewise the most northern. It is an old working, having been wrought for a lengthened period; and after having been with the Bog mine, now abandoned, the richest in the district, it still furnishes

* A medal has been awarded at the International Exhibition to the Rev. T. More, for a model in relief (Class I, No. 26) of the Shelve mining district.

two-thirds of all the lead produced in the county. Its importance induces the author to give more details than are strictly necessary, in a description of the ores treated at the Pontesford works.

The working is confined to one great lode, although the existence of another, 40 yards south (called the South Lode), has been established. This great lode is not distributed by any cross-course.

The country is a hard quartzose schist of a greenish-grey colour, slightly micaceous, belonging in age to the Llandeilo stage. It dips W.N.W., at an angle of 60°, conformably with the Stiperstones; and the strike of the bedding ranges N.E. and S.W. magnetic, or 22° east of true north, parallel with the Longmynd system. In the western part of the mine, alternations of soft shale are met with.

The average bearing of the lode is W. 22° N. magnetic (or W. 1° S., true), that is practically true east and west; but in places it varies widely from this for some length, for while the average bearing is thus W. 22° N., some parts of the levels bear W. 25° N., W. 32° N., E. and W., and a little to the south of west, all magnetic. The rich parts bear principally E. and W., and W. 25° N. magnetic. The lode crops out on the side of a hill facing the north, under which it dips (south), with a pretty regular underlie of 1 in 3, or 2 feet in 1 fathom.

The conditions of the occurrence of the shoots of ore, for the regularity of which this lode is so remarkable, will be best understood by a short sketch of the arrangement of the workings.

An old shaft is sunk vertically to the south of the lode, which it intersects at the depth of 80 yards: the levels are counted from the brace of this shaft, and not from the adit, which is here 110 yards deep, being brought up half-a-mile from the west: a water-wheel at the mouth of this adit, connected with the pumps in the shaft, by rods of this length, long sufficed for the drainage of the mine. The pumping is now effected by a steam-engine on the principal shaft, commenced 38 yards higher up on the hill, to the south of the old one. This shaft cuts the lode at the depth of 282 yards, and is further sunk to the depth of 372 yards, both computed from the brace of the old shaft, so that the real depth of the present shaft from surface is $372 + 38 = 410$ yards.

The levels on the lode are generally 30 yards apart, and are connected with the shaft by cross-cuts: at the 372 yard, the shaft is 40 yards behind the wall of the lode. In length the workings are extended about 800 yards to the east, and 400 yards to the west of the shaft.

The line of junction between the lode and the bedding of the strata, will thus hade at an angle of from 45° to 55° west from the horizon; and this is precisely the dip of the shoots of ore. Of these, six principal ones have been met with: the finest, situated to the west of the shaft, was as much 150 yards long in the one level.

Westward, the alternations of a softer shale with the micaceous schist correspond with an impoverishment of the lode, which is worthless in this shale. Eastward, on the contrary, that is in the lower beds of the formation, an extremely hard quartzose schist, with white veins, has been met with: after driving through this for about 350 yards, a better strata has been reached, under the old workings, of a greenish colour with white veins, in which the lode produces good fine-grained galena. It would appear that we should look for the future of the mine in this direction, where a new shaft is being sunk—destined to become the centre of a new working.

In its rich portions the width of the lode reaches 10 feet, but in the shale it is very small. The following are the principal minerals met with:—

Galena, for the greater part cleavable and in facettes; but at many points, particularly at present, fine steel-grained: both varieties are poor for

silver. Blende, also in two varieties, one fibrous and of a yellowish colour, the other brown and compact: the blende is found in spots, and even in large stones, but it is not intimately mixed with the galena. Iron pyrites: in frequent spots. Carbonate of lime, well crystallized and very cleavable: this mineral constitutes by far the principal gangue of the lode, and envelops the metallic minerals named. Crystallized sulphate of baryta, in certain parts of the mine only.* Quartz is not common, and is principally found where the lode is in a hard rock. And lastly fragments of the "country."†

There are three steam-engines on the mine. A 60″ Cornish pumping-engine, 6′ stroke in cylinder and 9′ in shaft, with 6½″ pumps, which shows that the water is not abundant. The second engine is employed for winding, and the third for crushing. The coal costs 18*s.* 6*d.* per ton on the mine, which includes 3*s.* 6*d.* carriage from Pontesford.

The number of miners employed underground is about 350; but there are only 50 persons employed in dressing operations. During the six years, from 1853 to 1859, the average production per month has been 218 tons of ore; but in the summer of 1860 it reached from 250 to 300 tons. The present dressing labour-cost is stated at 6*s.* 6*d.* per ton—that is since the recent introduction of the Yorkshire method, which has considerably diminished the cost and waste. Previous to this the cost was 16*s.* per ton of ore, while great quantities of ore were left in the waste. Even with the present system, however, the loss of lead is considerable; and it would certainly be advantageous to push the operations further than is done at present, and to return *judiciously* to an average cost of about 16*s.*

The mode and result of these dressing operations are shortly as follow:—

As the lodes even in its rich parts, afford very little massive ore, the necessity of getting a very pure ore does not allow of our counting much on the efficacy of spalling and picking by the hand; this operation only gets rid of the waste, and all the rest goes to the crusher.

On the other hand the galena is not finely disseminated, and the gangue is light and soft, so that it can be crushed large and easily, and the greater portion of the lead obtained by jigging.‡

The finer work, or the slimes, are treated on the round, and then on the square buddle. It is in this portion of the operation that the greatest waste occurs: in jigging, the skimmings also contain a notable quantity of galena.

The produce of the crop ore for lead, would probably reach by assay 81 per cent.; but in the case of the slimes, derived from the treatment of the fine-work, which, however, only form a small proportion of the whole, the produce is from 12 to 15 units below this—and would consequently only amount to from 66 to 69 per cent.

As to the foreign matters left in the ore sent to the smelting-house, they are evidently composed of the gangues above enumerated. Carbonate of lime probably dominates in the crop ore, in particles adhering to the grains of galena, while the blende would be found in the slimes; of the quartz and "country," but feeble traces would be found in either class.

* In 1858, Snailbeach sold 30 tons of sulphate of baryta, ready for crushing, at 1*l.* per ton; and in 1859, 49 tons of blende.

† Bituminous matter has been found in little nests in the Snailbeach lode. Near Pontesbury, a lead vein with a gangue of opaque quartz, was worked about fifty years ago, in which the same substance abounds. Even at present pieces from the waste heaps on the floors show, when broken, drops of black viscous bitumen.

‡ When a lot of large prills is thus obtained, that is larger than ⅜ths of an inch, it may be necessary to pass them again through the rollers, as the smelting works require the ore in a fine state.

The Stiperstone works, as stated, receive ores from various small mines, and are able to mix their galena with a little carbonate of lead; a mixture which facilitates the smelting. Their produce is a little less than that of Snailbeach, but then they contain less blende.*

The consideration of the remaining and principal portion of M. Moissenet's memoir, relating to the metallurgical operations of these works, we must postpone to a future occasion.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The thirty-second meeting of the British Association commenced its sittings at Cambridge on October 1st. In the evening Professor Willis took the chair and delivered an inaugural address. He recounted at great length the gradual progress and workings of the Association during the thirty-two years of its existence, referring to the report of the Manchester meeting, and instanced some of the most striking advances since made in the various sciences; concluding with a tribute to the memory of the Prince Consort and to Professors Cumming and Henslow.

The following were among the papers read in the sections named:—

Section A.—Mathematical and Physical Science. *President*, Mr. G. G. Stokes, F.R.S., Lucasian Professor of Mathematics. *Secretaries*, Professors Stevelly, H. J. S. Smith, and R. B. Clifton.

F. Galton—The "Boussole Burnier." A new French pocket instrument for measuring vertical and horizontal angles.

Prof. J. Thomson—On Disintegration of Stones exposed in buildings, and otherwise, to Atmospheric influences.

Section B.—Chemical Science. *President*, Mr. W. H. Miller, M.A., F.R.S., Professor of Mineralogy. *Secretaries*, Mr. W. Odling, M.B., F.R.S., and Mr. H. W. Elphinstone, M.A.

The President—Opening Address.

Dr. T. L. Phipson—Analysis of the Diluvial Soil of Brabant, &c., known as the Liman de la Hesbaye.

Dr. B. H. Paul—On the Decay and Fermentation of Stone employed in building.

Dr. B. H. Paul—On the Manufacture of Hydro-carbon Oils, Paraffin, &c., from Peat.

T. Sterry Hunt, M.A., F.R.S.—On some Principles to be considered in Mineralogical Classification.

Section C.—Geology. *President*, Mr. J. B. Jukes, M.A., F.R.S., Director of the Geological Survey of Ireland. *Secretaries*, Professor T. Rupert Jones and Mr. Lucas Barrett.

The President—Opening Address.

H. C. Sorby, F.R.S.—On the comparative Structure of Artificial and Natural Igneous Rocks.

Professor Harkness, F.R.S.—On the Skiddaw Slate Series.

Wm. Pengelly, F.G.S.—On the Co-relation of the Slates and Limestones of Devon and Cornwall with the Old Red Sandstone of Scotland.

Dr. L. W. Lindsay—On the Gold-fields of Auckland, New Zealand.

Dr. L. W. Lindsay—On the Gold-fields of Otago, New Zealand.

Professor Phillips, F.R.S.—Supplementary Report on Slaty Cleavage: Theoretical considerations.

Dr. T. Sterry Hunt, F.R.S.—Preliminary Report of the Committee for Investigating the Chemical and Mineralogical Composition of the Granite of Donegal, and the Associated Rocks.

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* The Stiperstone Company works a carbonate of baryta mine, of great purity, which sells on the mine for 3*l*. 10*s*. per ton.

Professor Ansted, F.R.S.—On Bituminous Schists and their relation to Coal.

Chas. Moore, F.G.S.—On the Palæontology of Mineral Veins, and the Oolitic age of some of the Mineral Veins in the Carboniferous Limestone.

T. A. Readwin, F.G.S.—On the Gold-bearing strata of Merionethshire.

Dr. T. Sterry Hunt, F.R.S.—On the Origin and Mode of Occurrence of the Petroleum of North America.

Dr. T. Sterry Hunt—On the Structure and Origin of certain Limestones and Dolomites.

SECTION F.—Economic Science and Statistics. *President*, Mr. Edwin Chadwick, C.B. *Secretaries*, Mr. Edmund Macrory and Mr. H. D. Macleod.

Henry Fawcett, M.A.—On the Economic Effects of recent Gold Discoveries.

SECTION G.—Mechanical Science. *President*, Mr. William Fairbairn, LL.D., F.R.S. *Secretaries*, Mr. P. Le Neve Forster, M.A., F.R.S., and Mr. W. M. Fawcett, M.A.

President's Address.

James Nasmyth—On an Improved form of "Link" Motion.

Edward E. Allen—On the Importance of Economising Fuel in Iron-plated Ships.

Wm. Thorold—On the Failure of the Sluice in the Fens, and on the Means of securing such Sluices against a similar contingency.

Professor D. T. Ansted, M.A., F.R.S.—On Artificial Stones.

G. B. Airy, M.A., F.R.S., Astronomer Royal—On the strains in the Interior of Beams and Tubular Bridges.

L. Williamson—The relative merits of Iron as compared with Wooden Ships, as regards Repair and Security of Life.

A. C. Tylor—On the Manufacture of Armour Plates.

THE NORTH OF ENGLAND INSTITUTE OF MINING ENGINEERS.

The monthly meeting was held on October 4th at the rooms of the Institute, Newcastle-upon-Tyne, the President (Mr. Nicholas Wood) in the chair. The question of the invitation about to be given by the Literary Society and other bodies to the British Association to hold their next annual meeting at Newcastle was ventilated, and a resolution was passed to co-operate in this matter.

The discussion on the Hartley accident was then opened. Mr. G. B. Foster said that nothing had transpired since the paper was written which required any remark from him; but he would be glad to answer any questions which any of the members might wish to put.

The President stated that there were four distinct questions in this most lamentable accident, all of which were necessary to bring about the serious results which had occurred:—1. The breaking of the beam.—2. Its falling down the shaft.—3. In doing so, its carrying away so much of the timber as to almost hermetically seal it; and—4. The formation of the poisonous gas, by which it was generally understood the lives had actually been lost. On these heads the following suggestions occurred to him:—1. The substitution of some other material than cast-iron for very large beams.—2. The using of kep-chocks, or other means, for preventing any portion of a beam, if broken, from going down the pit.—3. Securing the sides of shaft with stone instead of timber.

In answer to a question from a member,

Mr. G. B. Forster said it was his opinion that the accident was primarily caused by the breaking of one or more of the pumping spears. There were striking evidences in the engine that the beam had come "into the house" with great violence; and that the force of the concussion, when the catch pin struck the spring beams, had snapped the beam in the centre.

Mr. Atkinson (Her Majesty's Inspector of Mines for South Durham) corroborated Mr. Forster's statement. The cap fitted to the top of the piston-rod was broken by the force.

Mr. Brough (Her Majesty's Inspector of Mines for South Wales) agreed with the President that some mechanism should be made to prevent beams from falling down the shaft if broken; he also thought it advisable that all beams should be made of wrought-iron. He had recently seen at North Seaton Colliery a magnificent wrought-iron beam, made by Mr. Fairbairn. He was sure that any suggestions made by the members of the Institute would be listened to attentively by those interested in those matters.

The President thought they were as yet hardly in a position to recommend that all beams should be made of wrought-iron. It was, however, a very proper question to be entertained at this institute; and he hoped some member would raise its discussion by contributing a paper on the subject.

In reference to the nature of the gas which had been met with in clearing the shaft,

Mr. G. B. Forster stated he had been informed by two men who had worked in the Hartley mine that, in driving some leading places, they had felt similar physical effects to those experienced by the workmen engaged in clearing the shaft after the accident. Their lights were not at all affected, but they became sick and giddy.

Mr. Atkinson thought that, under certain circumstances, this might be attributable to the gases generated by the blasting-powder which they used.

Mr. Brough asked if it was clear that this gas, which was so fatal, was carbonic oxide, and not carbonic acid?

Mr. Daglish said that the action of carbonic acid gas, when so diluted as not at all to affect the burning of candles, as in this instance, could not have produced the very rapid effect on those exposed to its influence whilst clearing the shaft.

Mr. Atkinson said that, of course, the furnace was burning when the men went down. When the shaft became impervious to the passage of the smoke, that and the heat would hang about in its vicinity, and so prevent any one from approaching at once to put it out; and at the same time, from the deficient supply of fresh air, the circumstance would be most favourable for the generation of carbonic oxide.

In answer to a member, Mr. G. B. Forster stated that there was no evidence whatever for the supposition that any coal was on fire in the mine previous to the accident.

Mr. Brough was of opinion that carbonic oxide was not formed naturally in coal mines.

Mr. Daglish thought the proof of this was only a negative one. In the passage of wood film into coal large quantities of oxygen must have been eliminated, and it was not impossible that carbonic oxide was a product; and it now appeared that, in a state of vitality, plants did eliminate carbonic oxide.

Mr. G. B. Forster then read a letter which had appeared in the *Lancet*, from Mr. H. Davidson, surgeon, Seaton Delaval, giving a detailed account of the effect of the gas on those working in the shaft, and the appearance of those who were killed in the mine by it. The letter will appear, together with the discussion at full length, in the Society's "Transactions."

ROYAL GEOLOGICAL SOCIETY OF CORNWALL.

The annual meeting of this Society was held at their house at Penzance, on Friday the 10th of October, Mr. D. P. Le Grice, Vice-President, in the chair. A letter was read from Mr. Augustus Smith, M.P., the President,

expressing his wish to retire, his term of office having expired. Mr. Le Grice said he was sure they would all regret this determination, and at the close of the meeting it was resolved after some discussion that the meeting be adjourned until that day month, in order that Mr. Smith might be requested to act again as President, and also in the event of his refusing, to give time for deciding upon some gentleman qualified to take that office, and ascertaining his willingness to do so.

The papers read were:—"On the Age of the Maritime Alps about Mentone," contributed by a friend of the Society and read by Mr. William Bolitho; two papers by Mr. Pengelly of Torquay, read by Mr. Salmon, "On the Co-relation of the Slates and Limestones of Devon and Cornwall, with the Old Red Sandstones of Scotland," and "On the Supposed Uniform Height of Contemporary Raised Beaches," "Notice of a Singular Specimen much resembling a Chalk Flint, found in the Balleswidden Mine," St. Just, by Mr. S. Higgs, jun., and the "Gold Mines of Virginia," by Mr. W. J. Henwood, F.R.S., read by Mr. E. H. Rodd.

In the first-named paper Mr. Pengelly referred to the tripartite division made by Sir Roderick Murchison of the slates, limestones, and associated rocks of Devon and Cornwall, as well as of the Old Red Sandstone of Scotland, saying, that that division together with the consequent distribution of the characteristic fossils was not in keeping with the opinions of some who had laboured long and sedulously in those two counties. Sir Henry de la Bêche and the Rev. David Williams differed from Sir Roderick and from each other in this respect. That some diversity of opinion should exist respecting the true relations of the two systems of rocks named was to be expected, when we remembered their lithological and palæontological dissimilarity; the former teeming with fossil fish and the latter with the exuviæ of radiate animals. He said it would seem that the identification by Professor Phillips, of a fossil found near Torquay, as a Holoptychian scale had not been considered perfectly reliable, but there seems no satisfactory mode of accounting for the non-appearance of fishes in the slates and limestones of Cornwall and Devonshire. He went on to say that a short time since he had the good fortune to find a fossil in the pleurodictyum beds near Torquay, which had been afterwards identified as an unmistakable scale of *Phyllolepsis Concentricus*, a fish known only by its fossil scales. In the other paper Mr. Pengelly said that modern beaches exist at all levels within stated limits and without anything like graduation in their irregularity.

Mr. Higgs's paper described the discovery of a specimen "much resembling a chalk flint," found in a vugh, or cavity, about 18 inches square, at the depth of 130 fathoms, in the New Lode, at Balleswidden, which lode is imbedded entirely in the granite. For comparison, Mr. Higgs produced some "veritable flints," found scattered on the south-west slopes of Carn Kenigjack, in the neighbourhood. A comparison of the latter—which are undoubted flints—with the siliceous mass discovered in the mine, showed however that the latter could scarcely be properly called a "flint," for it seemed really to be a mass of chalcedony which was found in the vugh in the midst of a body of kaolin, or decomposed felspar. Of course it is not easy to say what constitutes the distinction between "flints," and chalcedony, but in Brooke and Miller's edition of Phillip's Mineralogy, the latter is defined as "a variety of chalcedony found in nodules in the upper chalk." The fracture of the specimen of chalcedony produced was also somewhat splintery, while that of the true "flint" is generally purely conchoidal; indeed the only thing common between it and the latter was its white surface, which it owed to the kaolin, and not to any calcareous matter as was shown by Mr. Henwood. The occurrence of these masses of chalcedony in lodes, particularly in granite, and accompanied by Kaolin, is by no means uncommon, as was stated by Mr. Garby, but they are always matters of

interest and worth recording. The occurrence of true flints scattered over a large portion of Cornwall and Devon, from Dartmoor to the Scilly Isles, is a matter of interest which has yet received little attention: they may be the residual traces of the denuded Mesozoic strata that probably once covered this region. The siliceous mass found in Balleswidden has, however, no relation or connection with these flints.

The meeting then proceeded to the election of officers for the ensuing year, when the following were elected on the nomination of the Council: Vice-Presidents:—the Earl of St. Germans, R. W. Fox, Esq., F.R.S., D. P. Le Grice, Esq., and J. J. Rogers, Esq., M.P.

For the Council:—J. Tremayne, Esq., Rev. N. M. Peters, J. St. Aubyn, Esq., M.P., J. M. Williams, Esq., F. M. Williams, Esq., J. Rule, Esq., J. S. Enys, Esq., T. S. Bolitho, Esq., S. Higgs, Esq., Richard Taylor, Esq., and H. Curwen Salmon, Esq.

The Geological Society of Cornwall, which at one time held a higher position than has been yet attained by any provincial society of the class, was founded on February 11th, 1814, by Mr. Davies Gilbert, M.P., F.R.S., and Dr. Paris (now President of the College of Physicians); and under the patronage of H.R.H. the Prince Regent, the Marquis of Hertford, Lord Warden of the Stannaries and Lord De Dunstanville, it soon attained a distinguished position. Of the original members only four survive—Mr. R. W. Fox, F.R.S.; Mr. Ashurst Majendie; Mr. John Scobell; and the Rev. Uriah Tonkin, Vicar of St. Ive's, Lelant and Towednack. Its successive secretaries have been—Dr. (now Sir John) Forbes, the eminent physician; Dr. H. S. Boase, F.R.S.; Mr. E. C. Giddy; Mr. W. J. Henwood, F.R.S., F.G.S.; Mr. Samuel Pidwell; Dr. L. R. Lillian, and Mr. R. Q. Couch, the present Secretary.

MINERS' ASSOCIATION FOR CORNWALL AND DEVON.

The annual meeting of this Association was held in the Committee-room of the Royal Cornwall Polytechnic Society on the 24th September, Mr. Charles Fox, President, in the chair. The President opened the meeting with an address, in which he referred to the papers of their lecturers, as showing that there was no attempt to give a *dilettante* view of science, but rather an accurate photographic image of its elements: that thus they had not diverged from the immediately practical paths. The Treasurer's reports would show how small were their means for a much less herculean work, and that there was a great deficiency even of necessary funds. Their Hon. Secretary had had such pressing duties at the Exhibition that he had not been able to direct his efforts to increase the number of subscribers, and many of the larger mines had not yet responded to his appeals. Their revenue was really not greater than the cost of sinking a winze or two. He (the President) had not lately visited the class-rooms, and did not know if any additions had been made in geological books and maps, sections of mines, drawing of machinery, and above all of specimens of rocks and lodes collected by the students and rightly named: until this was done, some of their acquired knowledge would be necessarily vague. He would suggest that the weekly mining report, when giving the value of the lode in the end, should also state the cost of driving it; and the bi-monthly accounts might give the amount of tributers' ore sold distinct from that of the adventurers.

Mr. Robert Hunt, F.R.S., the Hon. Secretary, next read his report, in which he stated that they had now ten classes receiving instruction, and if they had had funds these ten might have been twenty. The classes which had been receiving instruction during the past year were:—(1) *St. Just*, which had, he believed, been in existence since the establishment of the Association; (2) *Marazion;* (3) *Helston;* (4) *St. Day;* (5) *Redruth;* (6)

St. Agnes; (7) *St. Blazey;* (8) *Crow's Nest;* (9) *Gunnis Lake;* (10) *Tavistock.* These classes had been supplied with apparatus and chemicals; the teachers of chemistry and mineralogy, and of mechanics and surveying had been paid, together with their very heavy travelling expenses; with an income of less than 300*l.* per annum. Owing to the intense application he had had to give to other matters during the year, he had been prevented from performing a great portion of his duties as Secretary, and among them he had neglected soliciting, with few exceptions, mine-agents and others interested in mining property, their co-operation and support on behalf of the Association. He should, however, issue a circular letter soliciting subscriptions, and would urge the gentlemen of importance present to aid them: by this means he hoped to obtain an addition to their income, now only 300*l.* per annum, whereas the Association could not really be efficiently and successfully worked with anything less than 500*l.* a-year. There was one thing in which he felt there had been a failure, and that was that portion of the scheme which was sought to bring mine-agents together and induce them to record the result of their observations and experience, but he hoped that in a short time they should be able to progress in that direction as well as in others. He had received a communication from Lord Kinnaird, inclosing a resolution passed by the Royal Metallic Mines Commission, thanking the various witnesses in Cornwall and Devonshire for the readiness with which they had given evidence, and for the valuable information communicated by them.

The meeting was then addressed by Mr. R. Pearce (the lecturer of the Association) Mr. Cunnack, Mr. Cady, and Mr. Percival Johnson, F.R.S., the last-named gentleman dwelling on the importance of the ventillation of mines. A paper, by Mr. J. S. Enys, F.G.S., "On the Quantity of Change in the Rock-junctions at Beachy Head, Sussex, compared with the Intensity of the Changes in several Headlands on the Coast of Cornwall," having been read by Mr. Hunt, the meeting was again addressed by Mr. Pengelly, F.G.S., the Chairman, the Rev. S. Rogers, Mr. Hunt and Captain Thomas Richards.

This association was founded three years ago, under the auspices of Mr. Hunt, and has principally devoted itself to aiding the education of the youth of the mining classes scattered through the two counties, in connection with the examinations of the Science and Art Department. In this, as will be seen by Mr. Hunt's report, a fair amount of success has been achieved, considering the difficulty of operating over so great an extent. In securing as first President of the Association, Mr. Charles Fox—a name so well known and highly honoured in connection with mining in Cornwall —a most happy selection was made; the weight of his position and exertions, coupled with those of Mr. Hunt, who is so justly popular in those counties, cannot certainly fail to establish on a firm basis, an association so eminently useful in an educational point of view, if its establishment is practically possible.

THE NEW METAL *THALLIUM.*

BY WILLIAM CROOKES, F.C.S.

(Abstracted from the Proceedings of the Royal Society.)

Having so recently been honoured by the Council of the Royal Society with a grant from the Donation Fund for the purpose of defraying some of the expenses of my researches on this new element, I should not have ventured to offer to the Society so incomplete a notice as the present one, had I not within the last week heard that a continental chemist, Professor Lamy, of Lille, has recently been fortunate enough to meet with a residue containing thallium in considerable quantities, and has isolated the element and prepared several of its compounds: it therefore appears

advisable at once to place on record a description of several compounds of this body obtained since the date of my first announcement of its discovery in March 1861, but which I had purposely avoided publishing in order that it might form part of a more complete memoir on the subject which I had hoped at some future day to have the honour of submitting to this Society. I trust that, under these circumstances, I may be pardoned for bringing before the Royal Society an incomplete account of this new element.

The occurrence of a brilliant green line in some selenium residues, whilst examining them for tellurium, led me first to suspect the presence of a new element. This had been derived from a considerable quantity of the seleniferous deposit from the sulphuric acid manufactory at Tilkerode in the Hartz Mountains, which had been kindly placed at my disposal by Professor Hofmann; and the residue was that left behind on distilling the selenium which had been prepared from the deposit by appropriate chemical treatment. The processes through which it had passed limited the elements which could by any possibility be present to some half dozen; and as I was pretty confident that none of these presented in the spectroscope the phenomenon of a single bright-green line, it became of interest to investigate the subject further. In March 1861* I was enabled to announce definitely that the green-line substance was decidedly a new element, and that from some of its reactions it was probably a high member of the sulphur, selenium, and tellurium group, although I hesitated to assert this positively. The paper alluded to contained a sufficient number of the reactions of this body to enable me to prove chemically, as well as optically, that I was dealing with a new element possessing well-defined characters. Pursuing the investigation, I was enabled in the following May† to give a further account of this body, and to propose for it the name of *Thallium* (symbol *Tl*), from the Greek θαλλὸς, or Latin *thallus*, a budding twig,—a word which is frequently employed to express the beautiful green tint of young vegetation, and which I chose on account of the green line which it communicated to the spectrum recalling with peculiar vividness the fresh colour of early spring. In the same note I gave the localities and description of several minerals in which I had found the element, and also a method of extracting it from them in a pure state. Considering that I had sufficiently announced the discovery in these papers, which were republished in nearly every chemical journal in Europe, I turned my attention towards procuring a source of thallium which would enable me to prepare this body on the large scale; my experiments having hitherto been confined to mineralogical specimens which I had difficulty in tracing to their source, and the whole amount of thallium which I had as yet obtained not exceeding three grains in weight.

After some delay, Mr. Thornthwaite was good enough to supply me with a considerable quantity of crude sulphur distilled from Spanish copper pyrites. In this I found thallium present to the extent of one or two grains to the pound, and up to within the last few months it has been from the element prepared from this source that I have been working. I have recently, however, succeeded in finding an ore containing thallium, which is worked in this country, and from which I hope to be able to prepare the metal in larger quantities.

(To be continued).

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* Philosophical Magazine, S. 4, Vol. XXI, p. 301; and Chemical News, Vol. III, p. 194, March 30, 1861.

† Chemical News, Vol. III, p. 305, May 18, 1861.

Correspondence.

CONDENSATION OF LEAD FUMES.

SIR,—Referring to M. Fallize's proposed new form of lead condenser, I was favoured some time ago with an opportunity of seeing a condensing apparatus at the Gallowgate Lead Works, Newcastle-on-Tyne. The idea of this, I believe, was conceived by the fertile and philosophic mind of the late Mr. George Burnett, jun., Manager there, and, if I remember rightly, the principle of the scheme was to excite draft by the admission of steam, and in such a peculiar manner as to thorougly impregnate the fumes with it at the same time, and then to condense the steam and the smoke by contact in a square tower, or chimney shaft, of considerable height, filled, so far up, with coke, presenting a series of surfaces, upon which a self-acting tube of cold water was thrown at short intervals.

I cannot say whether this is still in operation or not, nor do I know as to its amount of success; but so far as I can discriminate between the principle of it and M. Fallize's, I think that they are very much alike.

I am acquainted with lead works where there are long flues for dry condensation. At these works, in many cases, the loss does not exceed 5·5 per cent. of lead, and the recovery of lead from the smoke is somewhere about two-thirds of the quantity volatilized by the smelter. While M. Fallize's figures would show a volatilization of, say 6·74 per cent. in a reverberatory furnace, and say 5·83 per cent. in a blast-furnace, of which he estimates the quantity recovered from the flues as rarely exceeding a quarter of this loss.

Of the comparative merits of the reverberatory and the blast furnaces I believe the general impression is in favour of the former as regards produce of lead; but M. Fallize seems to give the latter the preference. It would be interesting to know if M. Fallize's preferences on this subject are derived from actual experiment, under corresponding circumstances, and which he found preferable for the *quality* of the lead produced.

Yours truly,

3rd October, 1862. A SUBSCRIBER.

[We think our correspondent misunderstands M. Fallize in supposing that he gives a general preference to blast over reverberatory-furnaces in the smelting of lead. But certain classes of ores, found abundantly on the Continent, although comparatively rare in this country, are best treated in a furnace (*four à vent*) which in principle is a blast-furnace. In his paper in the *Revue Universelle*, of which we have only abstracted sufficient to make clear his proposed new form of condenser, M. Fallize points out that where the *raw* ore is put at once into such blast-furnaces the loss is very much greater, and he strongly recommends the preliminary calcination of the ore. In the particulars of a careful experiment made in 1859, on the comparative loss in a furnace of this kind, with raw and calcined ore, he found:—(1) That 32,000 kilogrammes of raw ore, containing by assay 16,276 kilogrammes of lead, yielded 13,430 kilogrammes of metal, giving a loss of 2,846 kilogrammes, of which loss 808 kilogrammes were contained in the slags, and 2,038 kilogrammes volatilized in the fumes—showing a loss by volatilization of 12·52 per cent. (2). On 36,115 kilogrammes of calcined ore, containing by assay 23,630 kilogrammes of lead, the yield of metal was 21,269 kilogrammes, giving a loss of 2,361 kilogrammes, of which loss 542 kilogrammes were contained in the slags, and 1,819 kilogrammes volatilized in the fumes, showing a loss by volatilization of 7·69 per cent. This 7·69 per cent. loss includes the loss of lead in the operation of calcination, which amounted to 2·78 per cent. of the lead contained in the ore.—ED.]

Mining, Quarrying, and Metallurgical Review.

CORNWALL AND DEVON.

THE principal feature of interest in this district during the month has been the rapid rise in the standards of tin ore, which have already advanced officially from 9*l.* to 10*l.*, at which rates there is such an active demand that some smelting-houses are reported to be buying ore at a further advance of 3*l.*, the official announcement of which is daily expected. As West Cornwall is at present producing about 900 tons of tin ore per month, and as the advance already announced makes a difference of fully 6*l.* per ton. in black-tin, it will be seen what an important matter this is to the country. To Dolcoath alone it will make a difference of 500*l.* a-month, and to Carn Brea 300*l.* a-month. The standard of copper ore, on the other hand, has declined about 3*l.* 10*s.*, which is rather a considerable fall.

Several improvements in mines have taken place within the last few weeks, particularly in the northern part of the Camborne and Illogan district, in North Roskear, Wheal Emily Henrietta, and New Seton.

In North Roskear a discovery of some importance has taken place in the western part of the mine; in sinking Pearce's shaft, which is 250 fathoms west of Doctor's engine-shaft, where there is a lode worth 150*l.* per fathom for the length of the shaft, 9 feet. The 184 end under this has also improved, and altogether a good piece of ore ground is being opened out. The ground about this shaft has long been the best in the mine, indeed that upon which it has for some time subsisted together with the tin ground in Wheal Crofty, so that there is nothing absolutely novel in the improvement, except that the lode is better than the average. There is a large piece of ground to explore west in this sett, parallel with New Seton and the western part of West Seton from which good results may be expected.

Wheal Emily Henrietta is a new mine divided into 1,024 shares, lying to the north of North Crofty. It was started some two years ago under the pursership of Mr. John F. Penrose of Redruth, Cashier of the Copper Company, many of the shareholders being samplers and persons connected with the copper trade. The ground was originally worked many years ago, when it was called Tolvadden mine after the name of the farm; its present name was given to it in honour to the Hon. Mrs. Basset. A portion of the ground was formerly granted to Wheal Seton, but in consequence of its not being worked the sett was revoked by Mr. Basset and granted to the present adventurers; a proceeding which led to an energetic protest from Mr. Tilly on behalf of the Seton adventurers. The lode worked seems to be a western continuation of the Wheal Tolgus and West Tolgus run, and is explored by three shafts—Penrose's engine shaft down to the 24, below which level it is now sinking; Angove's shaft, 50 fathoms west, down to the 32; and the western shaft down to the 44. The recent discovery was in the last-named shaft where a lode worth 30*l.* per fathom was cut into south from 4 fathoms above the 44 to that level. The country here, down for some distance, is capped by a dark twisty unpromising killas, which it is necessary to get through before much good can be expected. In the western shaft this was got through a little below the 30, and in the present bottom there is a beautiful killas, the effect of which is shown in the improvement in the lode. The eastern shafts have not yet got through this ugly cap of ground.

In New Seton stones of ore have been met with for some time in the 52 level, and recently in the centre of the engine shaft fine rocks of ore have been broken. In the 52 west there is a nice lode worth 10 cwt. per fathom, to the south of the flucan. This mine is one of the best held in Cornwall, and

is consequently a great favourite, which with the district accounts for the great price it maintains—upwards of 60,000*l*. Taking into consideration the district, however, this mine may, even at this price, after all prove one of the cheapest in the country. Although North Crofty has advanced in price, there does not seem to have been any material alteration in the mine, except that some stones of copper were met with in the 170 west. (See section of mine in August No., p. 75.)

At Great South Tolgus the rich tin lode in Lyle's shaft, sinking below the 140 still continues, the shaft being now down 8 fathoms below that level. Within the last two months the shaft has been sunk 16 feet, and from that extent of ground (shaft 13 feet long) 296*l*. worth of tin has just been sold in the stone, which shows 100*l*. per fathom for the length of the shaft. In the 140 level the tin did not last in length, but if it should do so in the 150, Great South Tolgus will be looking like a tin mine.

At Wheal Union a new lode has been cut in the 20 cross-cut south from the old engine shaft to the south of the elvan, of a promising nature, with good stones of ore: this lode comes immediately to the north of the East Carn Brea lodes. In Wheal Uny also a branch of ore has been cut in the new engine shaft (see Section, Vol. I, p. 315); but probably the advance in the price of tin will be the most important to this mine, where there is such large quantities of low quality tin-stuff available. At Rosewarne United account on the 22nd September, the number of shares was increased from 1,024 to 4,096.

WALES AND THE BORDERS.

South Wales.—The accounts received from the interior as to the state of trade are very cheering, describing the principal works and collieries in full employ, and this general activity being likely to be permanent, several additional furnaces will shortly be lighted. There has been good Continental demand for almost every description of Welsh iron, and it is expected that higher prices will be asked. The quantity of iron shipped at Cardiff for Spain, France, Italy, &c., has been larger than for some time previously. The coal trade has also been exceedingly brisk, and there is every reason to anticipate that the exports for the month of October will be fully equal to those of the previous month. The port of Swansea has been making large preparations for the great increase of trade reasonably expected consequent upon the opening of the direct Swansea and Neath Railway, which is being pushed forward with energy. There are some extensive orders in hand for rails and merchant bars, principally for Spain, Italy, France, and Russia.

The coal trade is in an active state, and there is no lack of demand for both house and steam coal. A general advance has been expected, but coalmasters are afraid that a rise would check the consumption, and thus cause a decline. There has been a large export trade, and the collieries have been fully employed.

The Ely Merthyr Colliery Company have commenced working their property at Gellygron, near Llantrissant, and so far the indications are said to be favourable.

An improved mill for blooming railway iron, is being erected at the Dowlais iron works, which is expected to give good results. There will be a saving in coal, and the labour saved by it will, it is anticipated, in a short time pay the expense of erecting it; it is not much more costly than other bloomings, and does not cover much space.

It is announced that a new iron work is to be established at Penarth, near Cardiff. This is important, taken in connection with the Penarth docks, harbour, and railway, and will no doubt materially improve the place.

The Clydach Iron Works were put up for sale at Abergavenny, on October 8th. The reserved price was 22,000*l.*, but there being no bid above that sum, no sale took place.

The export trade for the month of September shows a decided improvement as compared with the corresponding month of last year. The Newport docks and river are crowded with vessels, large importations of timber continue to take place, and Newport is gradually progressing as regards its import and export trade. Cardiff exported during September 136,269 tons of coal, and 17,099 tons of iron, which makes the total for the nine months 1,007,793 tons of coal, and 146,187 tons of iron, against 830,905 tons of coal and 108,686 tons of iron in the corresponding period of last year, showing an *increase* in coal of 176,888 tons, and in iron of 37,501 tons.

An abstract of the trade of Neath shows that the number of ships entering the harbour was 285, with an aggregate register tonnage of 21,152, the burden tonnage being 33,072. The imports were 3,824 tons of copper ore, 1,290 tons of pig-iron, 5,407 tons of iron ore, 723 tons of pit and cord wood, and 396 tons of timber; the exports were 28,395 tons of coal, culm, and coke, 79 tons of copper, 1,571 tons of bar-iron, and 155 tons of tin plates. These returns shows a considerable advance on former months.

Swansea has participated in the general prosperity of the district, and a far larger quantity of coal was exported during September both to foreign and continental ports than during any one month previously. From the statistical reports presented at the monthly meeting of the Harbour trustees, held on the 13th, we find that 517 vessels entered the port, having a registered tonnage of 58,030 tons. The total quantity of coals and iron exported has not been published by the Trust, but those competent to form an opinion say that there cannot have been less than 70,000 of coals shipped during the month.

The trade returns of Llanelly have not been published, but there has been a large business, the port having been full of ships, and of a larger class than generally visiting it. The trade with the coasting and near continental ports has been very brisk.

MERIONETHSHIRE.—The long anticipated gold-in-England mania seems to be upon us at last, and in rather an aggravated form, for we find that many of the least creditable of the old hands of the mania of 1854-5 are again in the field, and are pulling the strings of the New Companies, although they judiciously keep their names in the background. We have more than once expressed our opinion that a moderate and prudent trial of the gold-sprinkled veins of this county would be a fair speculation; and Mr. Warington Smyth, whose great experience of the district as the Crown Inspector, makes him the best living authority on the subject, has given the same opinion in our pages (see Vol. I, p. 379). In fact it is a duty to give a fair trial to such localities as Cwmheisian, Dolfrwynog, and one or two others; but as Mr. Smyth points out, this can only be done by a prudent and moderate mode of working—such a mode as has been carried out successfully by Captain John Parry at Glogau. When, however, instead of this we see companies starting with capitals of 50,000*l.*, out of which 30,000*l.* is to be paid to promoters for the privilege of trying what after all is but a hazardous experiment, the matter becomes very different. And the case becomes still worse when pieces of ground entirely out of the auriferous district are attempted to be palmed off on a gullible share-jobbing public under the cover of a prevailing excitement. Even in respect of the former case—that is where the ground may be considered a fair, although still hazardous, field for a moderate trial—Mr. Smyth very truly remarks "Capitals of 50,000*l.* or 80,000*l.* may be got up for these purposes, *or others*, but appear to me thoroughly unnecessary, for the mining is unattended by the heavy costs of engines, &c." This is too obvious to require dwelling upon, but then it is equally obvious that it is only out of

large capitals that promoters can hope to get a haul of 30,000*l.*; and this purpose—the "*other purpose*" which Mr. Smyth probably had in his mind when he wrote the sentence quoted—being no doubt the mainspring of the whole operation, the capital, and possibly the ultimate waste, must be arranged to suit it.

The following are the names and particulars of the gold companies that have appeared since our last number:—

The *United Dolfrwynogs Gold, Copper Mining Company*, Limited. The capital is to be 50,000*l.*, in shares of 1*l.* each; the mines to be worked are North Dolfrwynog, East Dolfrwynog, and West Dolfrwynog, immediately adjoining Dolfrwynog proper. The *Tyddynglwadis Silver, Lead, and Gold Mining Company*, with a capital of 30,000*l.*, in shares of 1*l.* each; to be worked in connection with Cwmheisian Issa. The *Cwmheisian Gold Mining Company*, capital 30,000*l.*, in shares of 1*l.* each. The *Sovereign Gold Mining Company*, capital 50,000*l.*, in shares of 1*l.* each; to work a piece of ground within three miles of Dollgelly.

The newest and neatest thing in the shape of nomenclature, is that of the Sovereign Company—a name redolent of bullion—and we suppose the next will be the Guinea Gold Company. The Secretary of this Company is Mr. Henry Peet, formerly connected with mining in the Tavistock district, and who brings to his duties some experience of gold mining in 1854-5; and it is also announced that the directors have secured the services of Captain Thomas Faull, described as late manager of the Almaden mines, California, as "head manager." This Mr. Faull, our readers may remember, made a report, a couple of months ago, on Wheal Ludcott, in Cornwall, which may be considered *unique*, even in the annals of mine reporting, for its glowing fervour.

GLOUCESTERSHIRE.—Among the imports into Bristol during the month, were 2,182 pieces of bar iron from Gothenburg, 330 tons of pig-iron from Glasgow, and 380 tons of sulphur ore from Pomaron. Respecting the general trade of the port, the customs duties for September amounted to 115,509*l.* 6*s.* 5*d.*; during that period 102 vessels entered the port, of an aggregate tonnage of 27,059.

MIDLAND COUNTIES.

STAFFORDSHIRE AND WARWICKSHIRE.—The North Staffordshire Coal and Ironmasters' Association held their usual quarterly meeting at Stoke-upon-Trent, on October 8th. The position and prospects of the trade were discussed at length. It was the general opinion that, as compared with other iron districts, North Staffordshire had secured its full proportion of orders for pig and finished iron during the quarter just closed, and held its position in the market well. For plates and angle iron there had been a good demand, though general sizes of merchant bars had been less active. As regards the present condition of the trade, it was stated as a good symptom that the orders for iron ran less upon particular descriptions, and showed more of a steady and healthy demand for all kinds in something like fair proportions. The works are pretty well employed, and hopes were expressed that during the current quarter they might be kept nearly in full work. It was mentioned that one firm in the district were about to enlarge their works, and that one or two others contemplate the erection each of an additional rolling mill, in hopes of an improved trade being not very far distant. The makers of pig-iron are well sold, and are not anxious for orders. Of thirty-five blast-furnaces in the district, twenty-three are in blast at the present time.

The foreign trade (excepting America) has been good, the continental demand has been rather beyond the average.

There has been a brisk demand for good thick coal, but for other sorts

the market has been dull, and many collieries have not been able to work full time for want of sufficient demand. The get of ironstone has been much reduced, and prices have been depressed.

NORTHERN COUNTIES.

NORTHUMBERLAND AND DURHAM.—The coal trade has improved a little of late, some collieries having been fully employed, but still many have been only partially so. At the last new winning at Seaton Delaval, the quantity worked has reached about 500 tons per day, and the workings are being extended on a very large scale. The other new winnings in the north have been making good progress, and promise to be most successful. A fortunate discovery has been made in the Broomhill Colliery, at the north-eastern edge of the coal-field, near Warkworth, the men having cut into a seam of coal 20 feet thick, of the best steam quality.

The iron trade has been very firm, and seems likely to continue so. Throughout the district of the Tyne and Wear and in Cleveland, the iron-masters have been doing well, and among others an immense blast-furnace has been blown in at the Consett iron works, which is expected to yield 400 tons of metal per week

The chemical market has been healthy, and the timber trade moderately active, so that altogether the two northern counties have had no cause of complaint.

Among the exports from the Tyne during the month have been 183,691 tons of coal, 57,276 cwts. of iron, and 16,486 tons of coke. Among the imports, cargoes of pyrites from Pomaron and Huelva; 7,582 bars of iron from Gothenburg; a quantity of irom from Archangel, and 38,114 bars of lead and 162 bags of copper from Carthagena.

SCOTLAND.

Coals have been in good demand for home use and for shipment, the exports have been extensive.

The pig-iron market has been quiet. The quantity shipped during September was 49,079 tons against 39,516 in the same month last year, showing an *increase* of 9,079 tons.

The miners in the employment of Messrs. Mohay, Mitchell, and Wallace, of the Clackmannan Coal Company, have struck for an advance of wages. The Keppock strike has terminated in the men returning to work at an advance of 6*d*. per day.

A good field of ironstone is said to have been discovered on the Wood Hall estate. The seam is said to be 3 feet thick, and of a valuable kind.

IRELAND.

The Irish mining mania, which has been actively raging for the last three or four years, although on a small scale compared with similar excitements in London, seems to be decidedly moderating. Like most people inexperienced in such matters, the Dublin speculators seem to have imagined that successful share-jobbing was synonymous with successful mining. Some have probably by this time learned their mistake, but scarcely to its full extent. Share-jobbing, with all its evils, is necessary in creating a market for any stock; and, consequently, however much we may dislike some of its features, is one of the necessities of our complicated modern civilization. But a market for any length of time, can only be established for things possessing an intrinsic value, which mining *trials*, that may *possibly* result in a mine, certainly do not. Of course, a factitious market may temporarily be established for things of the kind, for we see that such is the case every day; but young mining trials thus forced into

notoriety *invariably fail*, while the mines that really prove successes, are generally never heard of in the "market" until such a discovery is made as gives them an undoubted intrinsic value. This is the experience of Cornwall, almost without an exception; and the same will be found to be the case in Wales, and all the old mining districts of England. In fact, a young mining trial, which has no real value, worked in the face of large market transactions in its shares, has as little chance of success as an infant phenomenon has of turning out an able and accomplished man. The shares of the Wicklow Copper Mine Company, the Mining Company of Ireland, and a few others, are proper stock for market operations; but when we see that, in Ireland, purely speculative concerns are, as a rule, turned into market mines, we find no difficulty in predicting for them, from the experience of English districts, a career of signal failure. The result has so far borne out this view, for notwithstanding all the money invested, and all the excitement and jobbing, there has been no new recent success in Ireland. If there are to be new mines discovered there, we may be perfectly sure that they will *not* be in the market concerns we see weekly quoted and puffed; but among some modest trials, working privately, and which are as unknown to the "market" as were Wheal Buller, West Seton, South Caradon, or East Caradon, before they cut rich.

Among things in Ireland which, according to reports, are working out satisfactorily on a small scale are the *Burren Lead and Calamin Mines*, in the county of Clare, where deposits of lead and calamine are found cropping out to the surface in the mountain limestone. Whether calamine is of much value at present we can scarcely say; but such lead lodes as are here described would be worked to profit in the English limestone lead districts. Five lodes have been opened on, all productive, and, according to the reports of Mr. N. Ennor and others, the speculation is one of peculiar promise.

THE CONTINENT.

France.—As regards the iron trade of this country, it will probably be in a better condition when the expected cheaper rate of charcoal has been established. Refined pig has been quoted at St. Dizier at *5l. 2s.*, but this price has been almost nominal. After the reduction in charcoal, it is anticipated that well-situated works will be able to produce pig at *4l. 8s.* per ton. An establishment in the Moselle district has obtained a contract for a supply of 1,800 to 2,000 tons of rails required for a French line of railway, having competed with several powerful foreign houses. The Montat metallurgical establishment in the Haute-Marne, which has involved an outlay of 10,000*l.*, has just been sold by auction for 2,000*l.*

Belgium.—Plates have been in good demand. At Charleroi refined pig has been much sought after, and has fetched *5l. 2s. 6d.*; second fusion pig has been held at *6l.*, but the demand has not been active at this price.

Coal Markets.

London.—From the return of the Registrar of the London Coal Exchange, of the quantity of sea-borne Coal, Culm and Cinders, imported into London in the month of September, we learn that the total quantity was 260,199 tons against 292,814 tons during the corresponding month of last year—showing a *decrease* of 32,615 tons. The total quantity imported during the nine months ended September 30th, was 2,467,614 against

2,579,972 during the corresponding period last year—showing a *decrease* of 112,358 tons.

The following are particulars of the 260,199 tons imported during September:—

Newcastle ..	95,855 tons, in	264 ships		Scotland ..	1,372 tons, in	8 ships
Seaham ..	15,593 „	68 „		Wales ..	14,092 „	32 „
Sunderland .	72,422 „	175 „		Yorkshire ..	2,616 „	24 „
Middlesbro'.	5,542 „	26 „		Small ..	2,218 „	8 „
Hartlepool..	47,360 „	172 „		Cinders ..	1,062 „	5 „
Blyth ..	1,688 „	7 „		Culm ..	379 „	1 „

The quantity of coal imported by railways and canals during the month of September, was 146,279 tons against 138,084 tons during the corresponding month last year—showing an *increase* of 18,195 tons.

At the close of September, considerable arrivals caused a dull market for house-coal: Hartley's in fair demand. The prices for the different kinds were—best house-coal, 17*s.* 6*d.* to 18*s.* 6*d.*; seconds, 15*s.* 6*d.* to 16*s.* 6*d.*; Hartley's, 15*s.* to 15*s.* 9*d.*; manufacturers, 12*s.* to 14*s.* 6*d.* per ton. On the 1st, the tone of the market was dull for all kinds, but prices were without alteration, and only three cargoes remained unsold. On the 3rd, the quantity on sale was very trifling, and house-coal obtained rather higher prices. On the 6th, unusually large arrivals afforded an abundant supply of all descriptions of coal; there was a fair inquiry for house-coal at a reduction of 6*d.* per ton on last prices; Hartley's had rather a slow sale at a reduction also of 6*d.* per ton; manufacturers', in steady request. On the 8th, the market for house-coal was heavy, and in some cases there was another reduction of 3*d.* per ton. On the 10th, the market still continued dull for house-coal, but there was no alteration in prices; Hartley's dull, and a reduction of 3*d.* per ton took place. On the 13th, the tone of business was full at last prices, for all descriptions of coal. On the 15th, house-coal had a dull sale; manufacturers', steady. On the 17th, few arrivals imparted a firmer tone to business generally. The heavy gales of Saturday and Sunday having checked the progress of laden ships, there were only few arrivals on Monday, the 20th; the demand for house-coal improved considerably and advanced 6*d.* per ton; Hartley's scarce at an advance of 6*d.*; manufacturers quiet at previous rates; the market was entirely cleared of coal. On the 22nd the continued stormy weather again caused few arrivals. The demand for all coals was brisk, and an advance of from 6*d.* to 9*d.* per ton was established for all descriptions. On the 24th the expected fleet had not arrived, and house-coal met with a ready sale at last rates; Hartley's advanced 6*d.* per ton, making altogether an advance of 1*s.* 6*d.* to 1*s.* 9*d.* within a week.

General Exports of Coal.—By the monthly circular of Messrs. Laird, Liverpool, we learn that the quantities of coal exported during September was 841,035 tons, against 601,211 tons in the corresponding month of 1861, showing an increase of 239,824 tons. The particulars are—from the northern ports, 470,544 tons; Yorkshire, 36,346 tons; Liverpool, 62,724 tons; Severn ports, 212,423 tons; and Scotch, 58,998 tons. The increase was—northern ports, 140,179 tons; Yorkshire, 15,556 tons; Liverpool, 8,316 tons; Severn, 64,663; Scotch ports, 11,110 tons. Total exports, January to September, 5,997,428 tons, against 5,535,579 tons in 1861, showing an increase of 461,849 tons.

From Messrs. J. and T. Platt's Coal Circular for October, we find that the quantity of *coal, cannel, coke, and patent fuel shipped from Liverpool* to foreign and colonial ports during the month of September was 63,895, against 55,741 tons during the corresponding month of last year,—showing an *increase* 8,144 tons. The total quantity shipped during the nine months ending September, was 472,475 tons, against 498,245 tons during the same

period last year,—showing a *decrease* of 23,770 tons, The shipments coastwise during the months of September were 11,145 tons, against 7,253 tons during the corresponding month of last year, — showing an *increase* of 3,892 tons. The total quantity shipped coastwise during the nine months ending September was 60,635 tons, against 63,111 during the same period last year,—showing a *decrease* of 2,476 tons.

The return of the exports of coal from the port of Grimsby to foreign and colonial ports during the month of September, gives 11,727 tons, against 9,248 during the same month last year,—showing an *increase* of 2,479 tons.

The oversea exports of coal at Bristol during the month of September amounted to 1,067 tons, against 1,943 tons during the same month last year,—showing a *decrease* of 876 tons.

Metal Markets.

THE principal feature of the metal market during the month of October has been the great demand for and consequent rise in the price of tin; but a large amount of business has also been transacted in the other varieties of metals, and the advanced rates of all articles have been fully maintained.

IRON.—The iron trade has been very steady during the past month without experiencing much fluctuation. Scotch pig-iron began gradually to droop at the end of September. The speculative demand which marked the two preceding months having subsided business resumed somewhat its normal condition; but an absence of buying orders, in consequence of less encouraging news from America, caused a decline in price of from 57*s*. 6*d*. to 55*s*. 10½*d*. In the early part of October, the market somewhat recovered itself, but still with a downward tendency, which however gave place further on to a certain degree of activity, and prices rose from 55*s*. 6*d*. to 56*s*. 6*d*. Towards the close of the month the withdrawal of the bulk of the warrants from the market created a brisk demand, which resulted in an advance to 57*s*., at which the market closed firm.

Rails have been firm all through the month at 5*l*. 15*s*. to 6*l*.; and merchants well supplied with orders. Merchant bars opened steady at 5*l*. 10*s*. at the works, and 6*l*. 5*s*. f. o. b. in London. They have been in fair demand, the market having been chiefly kept up by the activity in railway bars. The closing prices are 5*l*. 15*s*. at the works, and 6*l*. 7*s*. 6*d*. to 6*l*. 10*s*. f. o. b. in London. Staffordshire descriptions have been in good request, and full prices were easily obtained for best brands. For Swedish bars the demand has been good with a somewhat limited supply; good Indian specifications 11*l*. 10*s*. to 11*l*. 15*s*.

STEEL.—Swedish keg has gradually improved during the month, and prices have advanced from 15*l*. to 15*l*. 10*s*. to 16*l*. for ordinary brands, and 17*l*. for Æ. B.

COPPER.—The market for English has been exceedingly firm, although quiet, all through the month; smelters having closely adhered to fixed prices both for raw and manufactured, and there has been a fair demand for both sorts. A good business has been done in foreign: Banca has been steady at 100*l*. and 100*l*. 10*s*. buyers. Kapunda has been held at 102*l*. to 103*l*. and 105*l*. Spanish was done at 95*l*., and Chili at 92*l*.

YELLOW METAL.—The demand for this article has been rather dull; sellers being unable to obtain more 8¼*d*. to 8½*d*. for brazery sheets. Sheathing however has kept its advanced price.

TIN.—The market for this metal has been characterised all through the month by great animation, which has resulted in the establishment of 4*l.* per ton, declared on the 25th, making, together with the advance which we reported on the 25th of last month, a total rise of 8*l.* within three weeks. During the early part of the month, English was in good demand, and firm at last advance. The rise of the 15th does not seem to have checked this demand the market having continued steady, with an extensive business doing at 118*l.* cash.

In foreign a very large business has been done in Straits, fully 10,000 slabs having changed hands within a week, and prices advanced from 116*l.* cash to 119*l.* three months, and 120*l.* for arrivals. In the beginning of the month small quantities of Banca sold at 116*l.* 10*s.*, but prices subsequently advanced to 119*l.* The Dutch market advanced to 69 f. buyers. In Holland sales are reported at 70 f.

TIN PLATES.—During the early part of the month previous rates were maintained ; makers being full of orders. Towards the close of the month, in consequence of the increased cost of raw material, prices were advanced, on charcoal 1*s.* per box, the last quotation being 27*s.* to 29*s.*, in Liverpool, coke 22*s.*

LEAD.—This metal has materially improved during the month, and a large business has been done at an advance of 10*s.* to 15*s.* on last month's prices ; good buyers at 21*l.*, W. B. 21*l.* 10*s.*

SPELTER.—The excitement which prevailed all through September has given place to a calmer tone. In the early part of the month the market was quiet, but without any material change in value. Towards the close of the month prices declined 5*s.* to 10*s.* per ton and few buyers, closing at 18*l.* 10*s.*, W.H. 19*l.*

Metallic-Ore Markets.

THE standard for black tin has advanced 10*l.* on the prices we gave last month, and now stands at—

Superior Fine	.. £115	Superior Common	.. £111
Second Fine	.. 113	Second Common	.. 110

The rapid rise in the price of tin has caused a corresponding advance in the standards of black tin. The first rise which took place at the end of September, too late to be noticed in our last number, was 3*l.*, this was followed the week after by another advance of 3*l.*, and on the 17th there was again a rise of 3*l.* on all kinds. On Common the advance has been 1*l.* more, and at these rates the market is very firm, smelters seeking tin and being frequently willing to give an advance on quoted prices, which is done without departing from the nominal quotations, by classing the tin a shade higher than it strictly deserves.

COPPER.—At the four Cornish sales we give this month, the number of tons, average produce, quantity of fine copper, average price per ton, and standard, have been as follows :—

Date.	*Tons.*	*Produce.*	*Fine Copper.* Tons. cwt.	*Price per ton.*	*Standard.*
Sept. 25.	3,220	$6\frac{7}{8}$	221 6	£5 17 0	£125 6 0
Oct. 2.	4,061	$6\frac{1}{8}$	250 18	5 2 6	127 7 0
„ 9.	2,466	7	172 7	5 14 0	121 6 0
„ 23.	5,929	6	352 7	4 15 6	126 9 0

Comparing the standards of copper ore, we find that after the final sale of last month, the tendency has been to decline. At the sale of September 25th, there was an advance of 1*l.* 15*s.*; at that of October 2nd, there was a decline of 1*l.* 5*s.*; at that of the 9th, there was a drop of 2*l.* 6*s.*; on the 16th there was no sale, and on the 23rd a slight decline took place, making altogether a decline of between 3*l.* and 4*l.* for the three last sales.

LEAD.—Comparing the sales of this month with those of last, we find that there has been upon the whole a slight advance.

London Share Market.

THE Mining Market has been extremely active all through the month and a large business has been transacted. Within the last few days indeed there has been less animation and prices have slightly receded, in sympathy with the general stock market, resulting from the troubled aspect of political matters in Greece and the proceedings of Commodore Wilkes in the Bermuda waters.

The greatest advance in price during the month has been in *North Roskear*, in which a large business has been transacted. Shares opened at 23½–24½, and have steadily advanced without any reaction to 50–52 at which price they close. A fine lode of copper has been cut in the western part of the mine in Pearce's shaft, sinking under the 174 worth 100*l.* per fathom for 6 feet long, or 150*l.* per fathom for the length of the shaft 9 feet. As this part of the mine is parallel with the West Seton there seems no reason why it should not make productive. A large fluctuating business has been done in *North Crofty*. Prices opened at 5⅜–5⅝ at which they were in great demand. On the 4th they advanced to 6¼–6½. On the 10th they rose 1*l.* a share, being quoted at 7¾–8¼. On the 14th they reached 8½, since which they have been flat and gradually receding, leaving off at 6¾–7. The general impression seems to be that the extreme advance was not justified by any proportionate improvement in the mine. Some transactions have taken place in *Wheal Emily Henrietta* a new mine on the market, in the same district. About the 9th shares were quoted at 8–9, towards the end of the month they were called 12–13.

There has been a great rise in *New Setons* which have advanced from 100 to 160. The first price was 100–105, on the 4th they rose to 107½–110½ and on the 15th they reached the highest price 160; they declined to 137½–142½ and went as low as 135 but rallied again, leaving off at 145–150. Some fine rocks of copper have been raised from the shaft at the 62, and there is every appearance of this being the top of a course of ore. In the early part of the month *Wheal Setons* were largely dealt in at fluctuating prices. They were first quoted 162½–165. The highest price was reached on the 9th when they were 165–170, but latterly they have been quiet at lower rates and close dull 155. *West Seton* 240–250.

East Caradons have steadily declined through the month and have altogether receded about 6*l.* per share or nearly 40,000*l.* on the

mine, notwithstanding the great efforts made to support the market. Shares opened at 52–53 and advanced on the 3rd to 53–54, since which they have gradually declined and leave off at 43¾–44¼. *West Caradons* were neglected in the early part of October, but a demand sprung up towards the end of the month, and quotations have advanced 3*l.*, closing at 35–36. *South Caradons* have been in good demand and have risen 35*l.* during the month, opening at 385–395 and closing at 415–425. *In South Caradon Wheal Hooper* transactions have been reported at prices ranging from 15*s.*–22*s.* *Gonamena* 2¼–¾. *Wheal Pollard* 10*s.*–12*s.*

A good business has been doing in *Marke Valleys*, which opened 10⅛–10⅜ and remained steady till the middle of the month when they receded to 9¾–10; from this quotation they improved slightly but still remained flat till the 24th, when they rallied and close strong at 10–10¼. Some transactions in *South Phœnix*. They advanced slightly from 2¼–2⅝ to 2½–2¾. In the early part of the month several transactions in *North Phœnix* at about 6⅛–¾. *West Rose Down* 18–19.

In consequence of the rise in the standard tin mines have been in great demand. *Cook's Kitchen* which opened quiet at 25½–26½ rose into great request on the 13th when prices reached 28 with many buyers and shares scarce, closing firm at 32. *Tincrofts* have also been in strong demand during the latter half of the month and prices have advanced from 11¾–12¼ to 13–13½. *Dolcoath* 560–570. *Condurrow* 62½–65.

Ludcotts have been quiet all through the month and on the whole have declined 30*s.* Shares opened at 12¾–13, but on the 10th quotations reached 12¾–13¼; they remained for some little time without alteration, after which they became flat receding to 11–11½ closing price. *Wheal Mary Anns* have been in demand at firmer prices and close at 15½–16. Some transactions in *Herodsfoot* which opened 43–44 closing at 41–42. *Wheal Trelawnys* have also been in request at 18¼–¾ but close flat 16–17.

Stray Parks also sharing in the general favour of tin mines have been in good request, shares have risen 6*l.*, from 34–35, the opening price to 40–42 at which they close. *Wheal Harriett* 34*s.*–36*s.* *Carn Camborne* 17*s.*–19*s.*

An extensive business has been done in *East Bassets* which have been in demand at steadily advancing prices, having risen 13*l.* to 14*l.* per share during the month. The opening price was 51–53; they gradually rose to 55–57 in demand; on the 25th they reached 65½–67½ but have since slightly receded closing 64–66. *North Bassets* have advanced from 2½–3 to 3–3½. *Wheal Basset* 80–85. *Wheal Buller* 52–57½. *Copper Hill* 60–62½.

The advance in the price of tin has checked the decline in *Great Wheal Fortune* and shares have become firm at a slight advance of from 26–27 to 27–28. The usual dividend will be given at the next account and the balance increased. *Calvadnacks* also which opened nominally at 2–2½ have trebled during the month; they sprang into demand on the 10th since when they have gone on steadily advancing and close at 6–7. *Wendron Consols* were in demand in the early part of the month in consequence of the improvement in the Bal

Dees part, and advanced to $13\frac{1}{4}$–$14\frac{1}{2}$. From this, however, they have again receded and close flat at 10–12. *Wheal Grylls* 28–30.

A fair business has been doing in *East Carn Brea* at firmer prices. They opened at 12–$12\frac{1}{4}$; on the intersection of the middle lode they advanced to 14–$14\frac{1}{2}$ from which they slightly declined and close at 14–$14\frac{1}{4}$. Towards the end of the month *Great South Tolgus* which opened dull at $4\frac{1}{8}$–$4\frac{3}{8}$, in sympathy with the general advance in tin mines rose into great demand and advanced to 6, leaving off at $5\frac{7}{8}$–$6\frac{1}{8}$. *Unions* opened quiet at 5–$5\frac{1}{4}$ but on the 16th jumped 2*l*. to 7–$7\frac{1}{4}$ in consequence of cutting a new lode; they close quiet at $6\frac{3}{8}$–$6\frac{7}{8}$. Transactions in *Wheal Uny* opened $6\frac{1}{8}$–$7\frac{1}{4}$ and closed at 7–$7\frac{1}{2}$. *South Carn Brea*, $2\frac{1}{2}$–$2\frac{3}{4}$.

In the Lelant tin district the mines have been in request at advanced rates. *Providence* recovered the fall of last month and advanced from 39–41 to 45–46. *Margarets* also recovered last month's decline, they opened at 41–42 closing at 45–46. *Rosewall Hill and Ransome United*, $3\frac{5}{8}$–$3\frac{3}{4}$. *Trelyon Consols*, $12\frac{1}{2}$–13.

Lady Berthas have been in demand during the latter part of the month, they opened at 12*s*.–15*s*., on the 24th they rose to 32*s*. 6*d*.–35*s*. at which they close. *Devon Great Consols* 480–493. *Kelly Bray* 10*s*.–12*s*. 6*d*. *Drake Walls* 17*s*. 6*d*.–20*s*.

North Downs have remained stationary all through the month closing at 3–$3\frac{1}{4}$. *North Treskerbys* have been dull at slightly receding prices; they opened at $3\frac{7}{8}$–$4\frac{1}{8}$ and close at $3\frac{7}{8}$–4. *West Tolgus* opened at 50–52 but have gone back to 49–51 at which they close.

South Frances which was first quoted at $97\frac{1}{2}$–$102\frac{1}{2}$ advanced in the middle of the month to $102\frac{1}{2}$–105, and close at a still further advance, at $102\frac{1}{2}$–$107\frac{1}{2}$. *West Frances* 14–15. *Wheal Grenville* which opened flat at $4\frac{1}{2}$–$5\frac{1}{2}$ sprung into a little activity and rose to $5\frac{3}{8}$–6, from which they again receded and close flat at 5–$5\frac{1}{2}$. *East Grenville* 53*s*.–55*s*.

Clifford Amalgamated have advanced from 22–24 to 24–25, some business done lately. *St. Day United* 10*s*.–11*s*. *Clijah* and *Wentworth* 4–5. *West Damsel*, 75–80.

East Rosewarnes have undergone no change being quoted at $2\frac{3}{8}$–$2\frac{5}{8}$. *Gurlyns* have not kept up last month's advance, last quotation $2\frac{1}{4}$–3. There has been a demand for *Cargoll* at an advance in price from 22–24 to 23–25.

Pendeen Consols have been in considerable request all through the month at advancing prices, having risen from $4\frac{1}{2}$ to 7, but leave off at 6–$6\frac{1}{2}$. *Wheal Kitty*, St. Agnes, advanced from 4 to $4\frac{1}{4}$–$\frac{3}{4}$ at which price there were many buyers. *West Polmear*, 5*s*.–7*s*. 6*d*.

Transactions are also reported in the following mines: *East Russell*, $3\frac{1}{8}$–$3\frac{3}{8}$. *Wheal Unity*, 15*s*.–17*s*. *Great Retallack*, 15*s*.–17*s*. 6*d*. *Wheal Crebor*, 7*s*. 6*d*.–10*s*. *Tamar Consols*, 17*s*. 6*d*.–22*s*. 6*d*. *Rosewarne Consols*, 3–$3\frac{1}{2}$. *North Robert*, 19*s*.–21*s*. *Bottle Hill*, 10*s*.–12*s*. 6*d*. *East Wheal Agar*, 8. *Wheal Reeth*, 20–$22\frac{1}{2}$. *Okel Tor*, 4–5. *Kingston Down Consols*, $2\frac{1}{4}$–$2\frac{1}{2}$. *Treloweth*, 1–$1\frac{1}{2}$. *Tolcarn*, 3–$3\frac{1}{4}$. *Worvas Downs*, 5–6.

Among Welsh mines, *Bryn Gwiog* opened at $25\frac{1}{2}$–$26\frac{1}{2}$ but gradually advanced through the month closing at 28–29. *Billins*, 16–17, at which price they have been dealt in.

In Colonial and Foreign mines, prices have been quoted as follows:—*Yudanamutana* opened at 2⅞, but in consequence of the favourable accounts received by the Australian mail prices gradually and steadily rose to 3¼ at which price they close. *Bon Accord*, ⅛. *Port Phillip*, 1⅜-½. *Scottish Australian*, ⅞-1. *Worthing*, ½. *Kapunda*, 1⅜-1½. *St. John Del Rey* opened at 54½-56¾ and steadily advanced during the month to 59-60½ at which price they close. *United Mexican*, have declined 7¼ to 5⅜. *Linares*, 6¼. *Cobre*, 21½-22. *Santa Babara*, 1-1¼. *East del Rey*, 1¾-1⅞. *Mariquita*, ⅞. *Fortuna*, 3⅝-4⅛.

New undertakings have been quoted at the following prices;—*St. David's Gold*, ⅛-⅜ prem. *Cambrian Gold*, ⅞-1 prem. *Dolfrwynog*, ⅛-⅜ prem. *West Clogau*, par to ¼ prem. *Sovereign Gold*, par to ¼ prem.

Provincial Share Market.

Dublin.—The following report is condensed from the *Mining Journal*:—

At the end of September, the shares of the *Wicklow Copper* Mining Company, changed hands at prices varying from 40*l.* to 40*l.* 10*s.*, and risen to 41*l.*, freely offered. The shares of the *Mining Company of Ireland* were also in increased demand at improving rates, closing at 19*l.* 5*s.*, buyers, making a total rise of fully 15*s.* per share for the week. In *Connorree* shares, a quotation of 27*s.* 6*d.* was effected, being an improvement of 1*s.* per share. *Carysfort* shares fully (2*l.* 10*s.*) paid, were bought at 35*s.*, being 5*s.* in excess of the price last brought by this series. Those of 1*l.* paid, changed hands at 17*s.* 6*d.*, but slightly receded to 17*s.*, and left off at an advance of 1*s.* on last price. *General Mining Company for Ireland* shares went back from 5*l.* 15*s.* to 5*l.* 10*s.*

Towards the beginning of October, the shares of the *Wicklow Copper* Mining Company went back to 39*l.* 10*s.*, at which figures, however, no large amount of business was transacted. *Connorree* shares were neglected. *General Mining Company for Ireland* shares weak, at 5*l.* 10*s.* *Carysfort* shares also receded, small parcels of shares changed hands at 16*s.* The shares of the *Mining Company of Ireland* in considerable demand, and freely taken at 19*l.* 7*s.* 6*d.*, being a further rise of 2*s.* 6*d.* on last advance.

In the early part of the month, *Wicklow Copper* shares kept at 39*l.* 10*s.* *Mining Company of Ireland* shares, after a drop of 2*s.* 6*d.*, recovered to, and maintained, the quotation of 19*l.* 7*s.* 6*d.* In *General Mining Company for Ireland* shares nothing done. Several transactions took place in *Connorree* shares, at the uniform price of 26*s.* 6*d.* *Carysfort* shares suffered a decline of 6*d.* per share, having changed hands at 15*s.* 6*d.*

In the middle of the month *Wicklow Copper* shares quoted at 39*l.* 10*s.*, although the directors did not declare any dividend. *Carysfort* shares, 1*l.* paid, rose from 15*s.* 6*d.* to 17*s.*, 17*s.* 6*d.*, and 18*s.* *General Mining Company for Ireland* shares were purchased at 5*l.* 7*s.* 6*d.*, or 2*s.* 6*d.* decline. *Connorree* shares brought at one time 26*s.* 6*d.*, but closed at 26*s.* *Mining Company of Ireland* shares made an upward movement, being freely taken at 19*l.* 15*s.*, but holders demanding 20*l.*, or an advance of 12*s.* 6*d.* on last price.

Towards the end of the month *Wicklow Copper* shares, 5*l.* paid, fluctuated between 39*l.* and 39*l.* 5*s.*, and left off at 39*l.* *Mining Company of Ireland* shares, 7*l.* paid, were largely dealt in at 19*l.* 10*s.* to 19*l.* 12*s.* 6*d.* Connorrees, 1*l.* paid, in demand at 25*s.* 6*d.*, sellers at 26*s.*

Tabular Abstract of Mining Accounts for the Month.

Date of [M]eeting.	Name of Mine, and Number of Shares.	Balances.		Calls.		Dividends.	
		Debit.	Credit.	Per Share.	Total.	Per Share.	Total.
		£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
	CORNISH AND DEVON MINES.						
[S]ept. 20	Wheal Vyvyan (1,024)	1,081 17 5	—	0 15 0	768 0 0	—	—
,, 22	Trevenen and Tremenheere (5,600)	544 17 10	—	0 2 6	700 0 0	—	—
,, 22	Copper Hill (256)	—	901 8 3	—	—	2 10 0	640 0 0
,, 22	Rosewarne United (1,024) ...	1,041 6 4	—	1 0 0	1,024 0 0	—	—
,, 24	West Basset (6,000)	—	2,038 16 5	—	—	0 6 0	1,800 0 0
,, 24	Wheal Harriet (5,120)	215 2 4	—	—	—	—	—
,, 24	Rosewall Hill and Ransom United (6,000)..................	—	997 1 1	—	—	0 2 6	750 0 0
,, 25	Drake Walls (12,800)............	—	859 11 7	—	—	—	—
,, 26	Cuddra (6,000)	638 14 3	—	0 3 0	900 0 0	—	—
,, 26	West Polmear (6,000)|	235 6 0	—	0 2 6	750 0 0	—	—
,, 29	Wheal Uny (4,096)..............	534 19 9	—	0 6 0	1,228 0 0	—	—
,, 29	Gonamena (6,144)	—	202 15 7	0 2 0	614 8 0	—	—
,, 30	North Phœnix (4,000)	288 5 11	—	0 2 6	500 0 0	—	—
,, 30	New Seton (400)..................	181 10 0	—	1 15 0	700 0 0	—	—
,, 30	East Gunnis Lake (4,000)	843 16 6	—	0 4 0	800 0 0	—	—
,, 30	Basset and Grylls (1,000)	—	262 13 5	—	—	—	—
,, 30	Craddock Moor (1,055)	—	1,141 3 2	—	—	—	—
,, 30	Wheal Arthur (5,990)	223 16 3	—	0 5 0	1,497 10 0	—	—
,, 30	South Caradon (512)............	—	5,641 7 3	—	—	5 0 0	2,560 0 0
[O]ct. 1	Boscundle (2,280)	375 0 0	—	0 5 0	570 0 0	—	—
,, 1	Wheal Kitty (Lelant) (1,024)	—	—	0 13 4	682 13 4	—	—
,, 3	Prosper United (6,000)	5,890 8 4	—	1 0 0	6,000 0 0	—	—
,, 3	Great Wheal Busy (6,000) ..	3,500 17 9	—	0 10 0	3,000 0 0	—	—
,, 4	Charlotte United (6,000)	1,553 16 0	—	0 5 0	1,500 0 0	—	—
,, 6	Tamer Silver Lead (9,600) ..	—	2,152 11 4	—	—	—	—
,, 6	Herodsfoot (1,024)	—	2,042 0 0	—	—	1 15 0	1,792 0 0
,, 7	Wheal Ludcott (4,800)	—	3,437 18 6	—	—	0 10 0	2,400 0 0
,, 7	Treskerby (512)	—	—	1 0 0	512 0 0	—	—
,, 7	Wheal Basset (512)	—	1,793 8 11	—	—	2 0 0	1,024 0 0
,, 8	West Caradon (1,024)	—	5,026 15 9	—	—	0 10 0	512 0 0
,, 8	North Trelawny (4,108)	119 17 7	—	0 2 0	410 16 0	—	—
,, 8	East Devon Great Consols (4,000)	186 0 10	—	0 2 6	500 0 0	—	—
,, 8	Wheal Margery (1,024)	805 3 4	—	0 10 0	512 0 0	—	—
,, 8	St. Ives Wheal Allen (1,024)	723 4 4	—	0 14 1	721 1 4	—	—
,, 9	Wheal Norris (6,000)............	1,447 8 6	—	0 5 0	1,500 0 0	—	—
,, 9	East Caradon (6,144)............	—	9,022 2 7	—	—	1 0 0	6,144 0 0
,, 9	West Rose Down (1,000)	61 11 9	—	0 15 0	750 0 0	—	—
,, 9	Marke Valley (9,000)............	—	2,551 15 5	—	—	—	—
,, 9	Carn Camborne (6,000).........	—	52 16 7	0 1 0	300 0 0	—	—
,, 9	St. Day United (4,000)	1,877 0 0	—	—	—	—	—
,, 13	Dolcoath, (358)	—	3,225 7 9	—	—	7 0 0	2,506 0 0
,, 13	Wheal Seton (396)................	—	2,120 14 4	—	—	2 0 0	792 0 0
,, 13	South Crofty (1,105)	—	—	1 10 0	1,657 10 0	—	—
,, 14	West Seton (400)	—	2,672 18 6	—	—	5 0 0	2,000 0 0
,, 14	East Tolgus (256)	—	—	3 0 0	768 0 0	—	—
,, 15	Camborne Consols (1,000) ...	130 9 3	—	0 10 0	500 0 0	—	—
,, 15	Trencrom (1,024)	1,397 0 0	—	1 7 3	1,395 4 0	—	—
,, 15	Tolvadden (6,000)	—	300 14 1	—	—	—	—
,, 16	Kelly Bray (5,000)	—	25 5 6	0 2 0	500 0 0	—	—
,, 16	New East Russell (6,514)	408 19 5	—	0 1 6	488 11 0	—	—
,, 21	South Carn Brea (6,000)	2,065 0 0	—	0 4 0	1,200 0 0	—	—
,, 21	Wheal Trannack (512)	—	14 8 4	0 5 0	128 0 0	—	—
,, 21	Wh. Kitty (St. Agnes) (4,295)	—	73 3 4	—	—	—	—
,, 22	Clifford Amalgamated (2,900)	—	1,471 0 0	—	—	0 10 0	1,450 0 0
,, 22	Rosewarne Consols (4,096) ...	—	551 0 0	—	—	0 2 0	409 12 0
,, 22	North Basset (6,000)	152 8 5	—	0 3 0	900 0 0	—	—
	WELSH & OTHER MINES.						
[S]ept. 19	Isle of Man	—	6,998 2 0	—	—	—	12 per ct.
,, 21	Dyfngwm (3,000)	—	1,239 13 2	—	—	0 2 6	375 0 0
[O]ct. 1	Dale Mine (30,000)...............	—	349 3 3	—	—	—	—
,, 10	Vale of Towey (20,000)	173 3 5	—	—	—	—	—
	FOREIGN MINES.						
[O]ct. 22	United Mexican (43,174)	—	10,299 0 0	—	—	0 5 0	8,634 12 0
,, 24	Fortuna (25,000)...................	—	4,836 3 1	—	—	—	—

Prices Current of Metals.

From Messrs. JAMES and SHAKSPEARE'S, 10, Austin Friars, E.C.

			Per Ton.		
IRON	Bars	in Wales	£5 17 6	@	£6 0 0
	„	„ Liverpool	6 10 0	„	6 12 6
	„	„ London	—	„	7 0 0
	Nail Rods	„ Wales	—	„	6 10 0
	„	„ Liverpool	6 15 0	„	7 0 0
	„	„ London	7 0 0	„	7 10 0
	Hoops (Staffordshire)	„ Liverpool	—	„	8 0 0
	„ „	„ London	8 7 6	„	8 10 0
	Sheets „	„ Liverpool	8 10 0	„	9 5 0
	„ „	„ London	9 0 0	„	9 10 0
	Bars „	„ Liverpool	—	„	7 0 0
	„ „	„ London	7 7 6	„	7 10 0
	Scotch Pig (No. 1. g.m.b.)	the Clyde	2 16 0	„	2 16 6
	Rails	in Wales	6 0 0	„	6 10 0
	Russian	C.C.N.D.	—	„	—
	Swedish—Hammered—large sizes		—	„	11 5 0
	„ „	Indian sizes	11 10 0	„	11 15 0
STEEL	Hammered—faggot		—	„	16 10 0
	„ in kegs ¼ and ⅜ in...		—	„	15 10 0
COPPER	Australian and other *fine* Foreign		—	„	101 0 0
	Foreign Slab, for Prod. 96 per Cent.		—	„	91 0 0
	English Tile and Tough		—	„	98 0 0
	„ Best selected		—	„	101 0 0
	„ Sheets, Sheathing and Rod		—	„	105 0 0
	„ Flat Bottoms		—	„	110 0 0
			Per lb.		
YELLOW METAL	Sheets, Sheathing and Rod		—	9*d.*	9½*d.*
			Per Cwt.		
TIN English	Common Blocks and Ingots		—	„	119*s.*
	„ Bars (in barrels)		—	„	120*s.*
	Refined		—	„	124*s.*
Foreign	Straits, Fine		118*s.*	„	119*s.*
	Banca		—	„	119*s.*
			Per Box.		
TIN PLATES at Liverpool 6*d.* Less	Charcoal IC, best		—	„	29*s.*
	„ IX „		—	„	35*s.*
	Coke IC		23*s.*	„	24*s.* 6*d.*
	„ IX		29*s.*	„	30*s.* 6*d.*
			Per Ton.		
LEAD	Sheet		—	„	21 10 0
	Pig—W.B.		—	„	21 10 0
	„ Ordinary brands		21 0 0	„	21 5 0
	„ Foreign, soft		—	„	20 5 0
	Red		—	„	22 0 0
	Shot		—	„	24 0 0
	Dry White		—	„	27 10 0
SPELTER	(Cake)		—	„	18 0 0
ZINC	(Sheet)		—	„	23 10 0
			Per Bottle.		
QUICKSILVER	(in bottles containing 75lbs. each)		—	„	7 0 0
			Per Ton.		
REGULUS OF ANTIMONY	French Star		—	„	43 0 0

A fair business doing in Metals, and quotations are firm for most articles.

TIN.—Several large parcels of *Straits* have been sold this week at 118*s.* @ 119*s.* according to quality and prompt.

SPELTER.—Is dull, and one or two forced sales have caused a fall of about 10*s.* per ton.

Copper Ores.

Sampled Sept. 10, and sold at the Royal Hotel, Truro, Sept 25.

Mines.	Tons.	Purchasers.	Price.		
North Treskerby	74	2	£5	11	6
	68	6	3	11	0
	64	1	4	19	6
	63	9	5	2	0
	62	7	4	14	0
	61	6	5	16	6
	58	11	4	14	6
	52	13	4	15	6
West Caradon............	76	1, 5, 6	8	18	6
	70	1, 5, 6	10	12	6
	64	11	6	6	0
	60	2	5	4	0
	57	5	5	2	6
	39	1, 5, 6	11	18	6
	38	1, 5, 6	8	17	6
	37	10	5	5	0
	25	1	1	5	6
South Caradon	78	5, 6	9	7	6
	75	3	6	8	6
	70	7	8	12	0
	64	1, 5, 6	17	10	6
	61	9, 11	8	19	7
	36	1, 5, 6	19	11	6
	35	3	5	18	6
	31	7	5	16	6
Great Wheal Busy......	62	7	2	3	6
	61	10	2	16	6
	60	8	3	10	6
	57	8	3	19	6
	56	5	3	19	6
	47	9	4	13	6
	39	1, 12	1	13	6
	33	2, 5	8	1	0
Clifford Amalgamated	91	6, 7	£4	6	6
(United Mines)	53	3, 10, 12	1	12	6
	33	12	2	2	6
	31	7	3	14	0
	30	1	0	8	6
	29	5	2	4	0
	28	3, 5	6	1	0
	27	5	2	14	0
	26	10	2	1	6
	16	7	3	9	0
Fowey Consols	80	10	5	5	6
	73	7	7	4	0
	66	1	6	3	6
	62	9	6	5	0
North Downs	62	6, 7	5	19	0
	57	8	5	18	6
	52	3	8	0	6
	44	3	5	0	0
Craddock Moor	67	6	6	16	0
	61	2, 6	7	13	0
Wheal Polmear	51	6	4	10	6
	44	5	3	18	6
	25	2	9	13	0
St. Day United	50	3	5	5	6
	39	7	1	12	6
	29	5	1	12	0
South Crinnis	40	6	5	18	6
	35	6	3	18	0
Burra Burra	24	13	5	7	6
	16	13	5	1	6
Perran Mines	21	1	3	15	6
Wheal Leisure	13	12	2	14	0
Wheal Prudence.........	12	1	4	18	6

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.		
North Treskerby............	503	£2,462	14	6
West Caradon..............	466	3,457	16	6
South Caradon	450	4,558	2	0
Great Wheal Busy	415	1,518	11	0
Clifford Amalgamated ...	364	1,092	10	6
Fowey Consols	281	1,742	13	0
North Downs	215	1,343	18	6
Craddock Moor.............	128	922	5	0
Wheal Polmear	120	£644	14	6
St. Day United	118	373	10	6
South Crinnis..................	75	373	10	0
Burra Burra	40	210	4	0
Perran Mines	21	79	5	6
Wheal Leisure	13	35	2	0
Wheal Prudence	12	59	2	0

EACH COMPANY'S PURCHASE.

	Tons.	Amount.		
1 Vivian and Sons	345½	£2,291	16	9
2 Freeman and Co.	206	1,331	19	0
3 Grenfell and Sons	287¾	1,684	19	2
4 Crown Copper Co..........	—	—		
5 Sims, Willyams & Co. ...	419½	2,803	18	0
6 Williams, Foster & Co. ...	575½	3,987	0	3
7 Mason and Elkington ...	460¾	2,348	18	9
8 Bankart and Sons	174	775	16	0
9 Copper Miners' Co.	202¼	£1,202	5	3
10 Charles Lambert	221¾	871	4	8
11 Newton, Keates & Co....	152¾	950	19	9
12 Sweetland, Tuttle & Co.	83½	166	11	11
13 Neath Copper Co.	92	458	10	0
Total..................	3220	£18,873	19	6

Average Produce, 6¾.
Quantity of Fine Copper, 221 tons 6 cwt.

Average standard £125 6 0
Average Price per ton 5 17 0

Copper Ores.

Sampled Sept. 17, and sold at Tabb's Hotel, Redruth, Oct. 2.

Mines.	Tons.	Purchasers.	Price.
Clifford Amalgamated	110	5	£5 13 6
(Wheal Clifford)	103	7	3 19 0
	102	1	5 12 0
	92	8	5 11 0
	87	1, 7	4 6 0
	78	7	4 18 0
	77	8	3 18 6
	75	3	6 4 6
	66	3	6 4 6
	52	8	3 18 6
	37	1	4 0 6
	26	13	3 16 6
(Consols)	53	3	6 2 6
	50	3	7 11 6
	2	5	49 17 6
West Seton]	91	6, 7, 8, 10	2 16 0
	81	1, 5	9 18 6
	73	8	7 3 6
	69	6	5 14 6
	65	7	5 2 6
	61	3	6 13 0
	60	7	5 14 0
	43	2, 7	8 4 0
Wh. Seton (Pendarves)	102	10	1 6 0
	64	9	5 5 6
	62	6, 7	4 12 6
	58	1, 5, 13	7 5 6
	53	1, 2, 5	14 0 6
	30	13	7 4 0
East Pool	73	6, 10	3 18 6
	60	8	3 6 0
	55	8	0 6 0
	51	6	6 11 0
	48	8	4 3 0
	42	6, 13	5 1 6
Tywarnhaile	90	12	2 10 0
	79	12	2 6 0
	58	7	6 11 0
	48	1	0 2 6

Mines.	Tons.	Purchasers.	Price.
Condurrow	85	13	£6 10 0
	63	10	1 13 0
	55	7	1 16 6
	31	9	2 8 0
	7	2	9 2 0
Tincroft	63	6, 7, 13	4 2 6
	60	7	4 4 6
	47	12	2 1 6
	44	12	2 1 6
	16	10	1 10 6
Wheal Basset	71	9	5 15 0
	66	7	4 12 0
	28	9	14 0 6
	27	1, 5	13 4 0
	21	9	6 5 6
South Frances	59	6	5 11 6
	53	6	6 8 0
	51	6	5 16 6
	25	6	13 15 6
	5	1	3 12 6
South Tolgus	71	3	6 15 0
	64	1	6 14 6
	45	9	2 17 0
East Basset	51	10	5 5 6
	42	7	5 3 6
	26	1, 5	7 6 0
Dolcoath *	52	6	5 2 6
	42	3, 10	3 3 0
Stray Park	45	10	2 8 0
	39	5	8 8 0
Camborne Vean	39	12	4 3 6
	34	13	6 10 6
Carn Camborne	26	1	3 9 6
	8	5	13 9 0
South Basset *	30	8	2 12 6
South Crofty	14	2	5 7 0
	10	9	1 8 0
Tredinnick's Ore	20	12	1 11 6

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.
Clifford Amalgamated	1010	£5,304 15 0
West Wheal Seton	543	3,410 18 0
Wheal Seton	369	2,138 4 6
East Pool	329	1,249 8 6
Tywarnhaile	275	792 12 0
Condurrow	241	910 13 6
Tincroft	230	726 12 0
Wheal Basset	213	1,592 14 6
South Wheal Francis	193	1,327 14 0
South Wheal Tolgus	180	£1,037 18 0
East Basset	119	676 3 6
Dolcoath	94	398 16 0
Stray Park	84	435 12 0
Camborne Vean	73	384 13 6
Carn Camborne	34	197 19 0
South Wheal Basset	30	78 15 0
South Wheal Crofty	24	88 18 0
Tredinnick's Ore	20	13 10 0

EACH COMPANY'S PURCHASE.

	Tons.	Amount
1 Vivian and Sons	4:9	£2,515 10 9
2 Freeman and Co.	60	562 13 6
3 Grenfell and Sons	397	2,532 3 0
4 Crown Copper Co.	—	——
5 Sims, Willyams & Co.	263	2,232 13 9
6 Williams, Foster & Co.	492	2,848 13 9
7 Mason and Elkington	726	3,375 19 0
8 Bankart and Sons	509	2,096 17 0
9 Copper Miners' Co.	270	£1,486 19 6
10 Charles Lambert	357	926 16 9
11 Newton, Keates & Co.	—	——
12 Sweetland, Tuttle & Co.	319	789 17 0
13 Neath Copper Co.	236	1,423 13 0
Total	4061	£20,781 17 0

Average Produce, 6¼.
Quantity of Fine Copper, 250 tons 18 cwt.

Average Standard £127 7 0
Average Price per ton 5 2 6

Copper Ores.

Sampled Oct. 8, and sold at the Royal Hotel, Truro, Oct. 23.

Mines.	Tons.	Purchasers.	Price.
Devon Great Consols	141	8	£4 18 0
	136	9	4 4 6
	128	8	4 6 0
	124	10	4 4 6
	114	2	4 1 6
	113	3	8 10 6
	110	1, 5	4 4 6
	107	1, 7, 8	3 17 6
	106	2	4 6 0
	105	3	8 8 6
	104	12	2 2 0
	100	8	4 1 6
	98	6	4 11 0
	97	1, 10	1 13 6
	95	6	4 8 0
	86	1, 10	2 10 6
	84	6	8 10 0
	77	6	7 19 6
	76	10	1 1 0
	74	1, 5	1 14 6
	70	10	0 18 6
	69	10	0 18 6
	68	1, 5, 10	2 4 0
	63	6	1 16 0
	59	6	4 18 0
	56	12	1 18 6
	53	10	0 16 6
	42	1	4 0 6
	27	6	5 4 0
	24	1	9 9 6
Phœnix Mines	122	5	5 4 0
	90	5	3 3 6
	72	7, 12	1 14 6
	60	1	3 12 0
	51	7	2 4 6
	48	1, 5	11 4 6
	47	1, 5	9 5 6
East Caradon	121	1, 5	6 2 6
	104	12	5 16 6
	77	5	5 2 0
	64	1, 5	8 16 6
	58	1, 5	10 2 0
	52	1, 5	8 15 6
Marke Valley	106	3	4 7 6
Marke Valley	105	3	4 19 6
	80	1	3 8 6
	71	12	4 1 6
	45	1, 3	2 13 6
Devon and Cornwall	87	10	3 3 6
	72	9, 10	1 17 6
	70	10	1 7 6
	39	1, 5	12 6 0
	32	8	4 6 6
Wheal Crelake	92	9	3 2 6
	85	11	6 10 6
	67	7, 13	4 8 6
	56	9	4 13 6
Bedford United.........	106	3, 7	4 18 6
	104	7	4 18 6
North Wheal Robert	92	9, 10	1 3 6
	54	9, 11	8 8 0
	29	9	4 2 0
	22	1	21 10 6
Wheal Friendship ...	55	9	7 10 6
	51	2	10 4 0
	29	1, 5	9 13 0
Wheal Emma	52	6, 12	4 1 6
	47	6	7 6 6
	31	1	1 5 6
Wheal Yarner	103	5	2 17 0
Wheal Arthur	51	8	4 10 0
	50	7, 13	2 6 0
Sortridge Consols......	71	9	7 7 6
	24	2	3 15 0
Gunnis Lake (Clitters)	47	6	5 4 0
	40	6	6 5 0
Brookwood	65	6	5 0 6
Molland	50	8	5 10 6
Fursdon	29	7	2 14 6
	15	7	4 17 0
Bampfylde	31	12	18 2 6
Feock Regulus	29	3	4 1 6
Wheal Rose	28	3, 7	4 13 0
Hawkmoor...............	24	11	3 16 6
Great Tregune	14	1	9 5 6
Furze Park	5	7	10 8 0
Cook's Ore..............	2	8	12 1 6

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.
Devon Great Consols......	2,606	£10,761 9 6
Phœnix	490	2,348 11 0
East Caradon	476	3,348 9 0
Marke Valley	407	1,669 16 6
Devon and Cornwall......	300	1,125 11 6
Wheal Crelake	300	1,400 8 0
Bedford United	210	1,034 5 0
North Robert	197	1,154 3 0
Wheal Friendship	135	1,213 18 6
Wheal Emma	130	595 14 0
Wheal Yarner...............	103	293 11 0
Wheal Arthur...............	101	444 10 0
Sortridge Consols...............	95	£613 12 6
Gunnis Lake........................	87	494 8 0
Brookwood........................	65	326 12 6
Molland	50	276 5 0
Fursdon	44	151 15 6
Bampfylde.........................	31	561 17 6
Feock Regulus	29	118 3 6
Wheal Rose	28	130 4 0
Hawkmoor..........................	24	91 16 0
Great Tregune	14	129 17 0
Furze Park	5	52 0 0
Cook's Ore	2	24 3 0

EACH COMPANY'S PURCHASE.

	Tons.	Amount.
1 Vivian and Sons............	755½	£4,068 0 6
2 Freeman and Co.	295	1,530 11 0
3 Grenfell and Sons	547½	3,338 11 3
4 Crown Copper Co..........	—	——
5 Sims, Willyams & Co. ...	746¾	4,232 6 4
6 Williams, Foster & Co....	728	4,006 2 6
7 Mason and Elkington ...	401½	1,561 12 5
8 Bankart and Sons	539¾	2,455 6 2
9 Copper Miners' Co.......	548	£2,528 13 0
10 Charles Lambert	745½	1,509 14 1
11 Newton, Keates & Co...	136	873 4 6
12 Sweetland, Tuttle & Co.	428	1,951 5 0
13 Neath Copper Co.	58½	205 14 9
Total	5929	£28,261 1 6

Average Produce, 6.
Quantity of Fine Copper, 352 tons 7 cwt.

Average Standard £126 9 0
Average Price per ton............ £4 15 6

Copper Ores.

Sampled Sept. 19, and sold at Swansea Oct. 7.

Mines.	Tons.	Produce.	Purchasers.	Price.		
Cobro	96	13¾	3	£11	17	0
	94	13⅝	5	11	16	0
	92	13⅜	5	12	1	0
	90	13¼	1, 13	11	19	6
	84	14	6, 7	12	1	0
	52	23⅝	7	20	10	0
	49	24	3, 7	20	17	0
	44	20⅞	14	18	12	0
	15	63⅞	3	54	1	0
	14	62	10	53	5	6
Knockmahon	71	9⅞	7	8	8	6
	70	9½	2, 7	8	6	0
	93	11⅞	2, 7	10	10	6
	60	11⅝	2	10	10	6
	57	11⅜	2, 7	10	8	6
Knockmahon	94	5⅝	2, 7	£4	4	0
Berehaven	100	11½	9	9	16	6
	80	11¼	9	10	7	6
	79	10⅝	6	9	1	0
Burnt Ore	107	3½	1, 6, 14	2	9	0
Worthing, S.A.	48	51½	10	44	15	6
Brada United	42	5¼	1, 15	4	12	6
Laxey	34	4⅞	3	3	11	6
Piedmont	18	14⅞	1	13	4	6
West Kame	16	3⅞	6	2	16	0
ConnorreePrecip.	16	61	5	53	10	6
Kanmantoo	16	50½	14	44	0	0
British Regulus	12	40⅜	14	35	5	0
Bathurst	7	20⅜	14	18	14	0
Spring Creek	5	32¼	14	30	0	0

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.		
Cobre	630	£9,894	0	0
Knockmahon	445	3,778	10	6
Berehaven	259	2,527	0	0
Burnt Ore	107	262	3	0
Worthing, S.A.	48	2,149	4	0
Brada United	42	194	5	0
Laxey	34	121	11	0
Piedmont	18	£238	1	0
West Kame	16	44	16	0
Connorree Precipitate	16	856	8	0
Kanmantoo	16	704	0	0
British Regulus	12	423	0	0
Bathurst	7	130	18	0
Spring Creek	5	150	0	0

EACH COMPANY'S PURCHASE.

	Tons.	Amount.		
1 Copper Miners' Co.	119¾	£961	8	8
2 Freeman and Co.	217	1,905	18	6
3 Grenfell and Sons	169½	2,580	14	6
4 Crown Copper Co.	—	——		
5 Sims, Willyams & Co.	202	3,074	4	0
6 Vivian and Sons	172¾	1,353	4	8
7 Williams, Foster & Co.	346½	3,955	10	6
8 British and For. Copper Co.	—	——		
9 Mason and Elkington	180	1,812	10	0
10 Bankart and Sons	62	£2,881	1	0
11 Charles Lambert	—	——		
12 Ravenhead Copper Co.	—	——		
13 Sweetland, Tuttle & Co.	—	——		
14 Jennings and Co.	119¾	2,313	13	8
15 Neath Copper Co.	66	636	0	0
Total	1655	£21,474	5	6

Black Tin Sales.

Date.	Mines.	Tons.	c.	q.	lbs.	Price per ton £	s.	d.	Purchasers.	Amount of Money. £	s.	d.
Sept. 18.	Great Wheal Vor	23	5	0	12	—			—	1568	4	6
„ 18.	Trevenen	8	17	0	26	68	10	0	Charlestown Co.	652	7	1
	„	1	1	2	10	42	0	0	ditto			
	Wheal Vyvyan	0	18	3	27	62	10	0	ditto	68	15	8
	„	0	4	1	22	42	0	0	ditto			
„ 20.	Leeds and St. Aubyn	4	5	0	14	63	0	0	Chyandour Co.	268	2	6
	Wheal Harriett	7	3	0	0	—			—	444	3	6
„ 22.	Gt. Wh. Fortune	26	12	0	25	—			Redruth Co. Chyandour	1862	8	6
„ 23.	Cuddra	3	9	3	9	64	0	0	Charlestown Co.	233	15	8
	„	0	4	1	6	48	0	0	ditto			
„ 24.	Garlidna United	5	17	1	1	68	5	0	Bissoe Co.	493	2	7
	„	1	11	0	14	59	15	0	ditto			
„ 29.	Gt. Wh. Busy	18	9	0	7	—			—	1093	2	4
„ 30.	Pedn-an-drea	11	9	1	13	—			Chyandour Co.	738	3	6
Oct. 2.	Wheal Hearle	4	18	3	2	62	15	0	Bolitho and Sons	309	17	6
	Par Consols	65	11	1	25	—			—	8461	17	8
„ 11.	„	62	11	0	2	—			—			
	Great Work Consols	15	10	0	9	74	10	0	Bissoe Co.	1155	0	11
„ 14.	Gurlyn	7	0	0	13	65	0	0	Chyandour Co.	456	7	6
„ 15.	Penhalls	6	0	0	23	—			—	411	13	2
„ 16.	West Beam	10	6	2	26	71	0	0	Bissoe Co.	780	9	5
	„	0	13	0	16	70	11	6	Daubuz and Co.			
„ 17.	West Fowey Consols	16	9	0	12	—			—	1083	19	11
	Trevenen	6	16	0	6	74	0	0	Enthoven and Sons	558	12	6
	„	1	3	1	0	47	0	0	ditto			
	Wheal Vyvyan	1	14	3	12	67	0	0	ditto	1338	1	9
	„	0	8	3	5	48	0	0	ditto			
„ 18.	Gt. Wh. Vor. Utd.	21	8	2	24	—			Mellanear Co.	1560	12	0
	Pedn-an-drea	10	13	3	3	—			Carvedras Co.	739	5	3
	North Wheal Jane	2	17	2	13	—			—	190	19	9

Copper Ores.

Sampled Sept. 24, and sold at Tabb's Hotel, Redruth, Oct. 9.

Mines.	Tons.	Purchasers.	Price.	Mines.	Tons.	Purchasers.	Price.
West Basset	73	8	£4 10 6	Rosewarne Consols	63	9	£9 1 6
	72	1, 7	4 13 0		49	7	9 14 0
	66	1, 5	7 3 0		20	9	2 10 6
	64	5	4 8 6	Treloweth	45	10	4 14 0
	59	2	4 8 6		37	8, 10, 11	4 8 6
	31	2, 5	5 8 6		21	7	13 4 6
	22	12	2 4 6		10	5	0 7 0
	19	1, 5	4 12 0	East Crin. & South Par	51	1, 5	1 11 6
Carn Brea	120	1, 5	0 0 6		49	10	4 4 6
	63	10	3 0 6	Rosewarne United	38	11	4 7 0
	60	11	5 14 0		37	3	10 4 0
	48	3	7 2 0		21	3	8 15 0
	46	10	3 12 0	Copper Hill	39	13	6 6 6
Par Consols	67	6	7 4 6		26	10	1 17 6
	62	3	6 10 0		6	7	16 11 0
	60	1, 2	10 17 6	Wheal Buller	56	9	3 8 0
	59	1	13 1 6		14	7	13 1 0
	36	3	4 11 0	West Alfred Consols	62	10	1 4 6
Botallack	95	8	3 8 6		7	7	2 7 0
	50	1, 5	9 4 0	West Fowey Consols	63	2, 5, 6	7 17 0
	38	8	9 11 6	Charlotte United	33	6	6 19 6
	32	8	6 9 6		27	1, 5	2 15 6
Great South Tolgus	61	6	8 0 6	New Treleigh	54	5, 10	3 16 0
	46	3, 7	11 3 0	Great Wheal Alfred	43	5, 7, 10	2 8 0
	45	2	7 17 6	Wheal Unity Consols	15	8	4 10 6
Pendeen Consols	74	1, 5	3 13 6	Camborne Consols	15	9	7 3 0
	52	5	4 6 6	Great Work	14	6	8 19 0
	14	8	2 10 6	South Dolcoath	4	1	11 12 6
	10	1, 5	28 5 6	Old Tolgus United	3	3	3 2 0

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.		Tons.	Amount.
West Basset	406	£1,985 16 6	Wheal Buller	70	£373 2 0
Carn Brea	337	1,041 19 6	West Alfred Consols	69	92 8 0
Par Consols	284	2,474 16 0	West Fowey Consols	63	494 11 0
Botallack	215	1,356 8 6	Charlotte United	60	305 2 0
Great South Tolgus	152	1,356 16 0	New Treleigh	54	205 4 0
Pendeen Consols	150	814 19 0	Great Wheal Alfred	43	103 4 0
Rosewarne Consols	132	1,097 10 6	Wheal Unity Consols	15	67 17 6
Treloweth	113	656 9 0	Camborne Consols	15	107 5 0
East Crinnis & South Par	100	287 7 0	Great Work	14	125 6 0
Rosewarne United	96	726 9 0	South Dolcoath	4	46 10 0
Copper Hill	71	394 14 6	Old Tolgus United	3	9 6 0

EACH COMPANY'S PURCHASE.

	Tons.	Amount.		Tons.	Amount.
1 Vivian and Sons	337½	£2,177 14 0	9 Copper Miners' Co.	154	919 17 6
2 Freeman and Co.	170½	1,190 12 9	10 Charles Lambert	344½	1,093 19 6
3 Grenfell and Sons	230	1,734 10 0	11 Newton, Keates & Co.	110½	561 17 6
4 Crown Copper Co.	—	——	12 Sweetland, Tuttle & Co.	22	48 19 0
5 Sims, Willyams & Co.	412½	1,763 13 3	13 Neath Copper Co.	39	246 13 6
6 Williams, Foster & Co.	196	1,493 18 6			
7 Mason and Elkington	170½	1,509 14 6	Total	2466	£14,123 1 0
8 Bankart and Sons	279½	1,384 11 0			

Average Produce, 7.
Quantity of Fine Copper, 172 tons 7 cwt.

Average Standard £121 6 0
Average Price per ton 5 14 0

No Sale on October 16th.

Sundry Copper Ore Sales.

Date.	Mines.		Tons.	Price per ton. £ s. d.	Purchasers.	Amount of Money. £ s. d.
Sept. 26.		Lot 1	69	19 18 0	C. Lambert	8451 12 0
		2	69	20 2 0	ditto	
		3	68	20 10 0	ditto	
		4	68	20 16 6	ditto	
		5	68	21 0 0	ditto	
		6	68	21 8 0	ditto	
	ex Jamestown	Lot 1	91	10 14 6	St. Helen's Co.	4730 4 6
		2	80	9 17 0	Newton, Keates, & Co.	
		3	46	10 15 0	ditto	
		4	92	10 18 3	Evans and McBryde	
	ex Mary Joseph	5	75	10 3 6	St. Helen's Co.	
		6	64	10 0 6	Newton, Keates, & Co.	
Oct. 21.	Parys Mines	Lot 1	100	6 0 9	C. Lambert	1209 6 0
		2	56	6 1 0	J. Keys and Son	
		3	110	2 8 6	J. Radley, jun.	

Lead Ore Sales.

Dates.	Mines.	Tons.	Price per Ton. £	s.	d.	Purchasers.	Amount of Money. £	s.	d.
Sept. 25	Westminster	14	12	2	0	Newton, Keates & Co.	169	8	0
	Maesysafn	70	12	10	6	Walker, Parker & Co.	876	15	0
	Mount Pleasant	12	12	5	6	ditto	147	0	6
	Hendre Ucha	15	12	15	0	A. Courage and Co.	191	5	0
	Bryngwyn	10	12	15	0	Walker, Parker & Co.	127	10	0
	Pant-y-Buarth	12	12	9	0	Newton, Keates & Co.	149	8	0
	Pennant	14	13	3	0	Adam Eyton			
	"	4½	12	13	0	Walker, Parker & Co.	262	17	0
	"	1½	14	11	0	Adam Eyton			
	Lower Park	5	12	7	0	Newton, Keates & Co.	61	15	0
	Dyliffe	113	12	16	0	ditto	1446	8	0
	Llanerchyraur	40	13	10	0	ditto	540	0	0
	Roman Gravels	26	13	0	0	Walker, Parker & Co.	338	0	0
" 29.	East Logylas	60	12	5	0	ditto	735	0	0
	Cwmystwith	100	12	14	6	ditto	1272	10	0
	Glogfach	60	15	7	0	Mining Co. of Ireland	921	0	0
	Goginan	34	16	11	6	ditto	654	9	0
	"	6	15	3	0	Sims, Willyams & Co.			
" 30.	Isle of Man Mining Co.	100	20	6	0	ditto	2446	5	0
	(silver chats)	30	13	17	6	Newton, Keates & Co.			
	Carmarthen United	30	13	9	0	Sims, Willyams & Co.	403	10	0
	Castleward United	40	12	1	0	ditto	482	0	0
Oct. 1.	Dyliffe	65	12	17	0	Adam Eyton	835	5	0
" 2.	South Exmouth	80	12	7	6	T. Somers	990	0	0
" 3.	Minera	100	12	16	6	Walker, Parker & Co.			
	"	100	13	13	6	ditto			
	"	100	12	17	6	ditto			
	"	100	12	14	6	ditto	8370	0	0
	"	100	13	0	6	ditto			
	"	100	13	1	0	Adam Eyton			
	"	50	13	1	0	ditto			
" 4.	Wheal Mary Ann	55	27	10	6	Stock and Co.	1943	0	0
	"	35	12	5	6	Sims, Willyams & Co.			
" 9.	Talargoch (Macsyrerwddu)	33	13	11	0	A. Courage and Co.	1259	3	0
	" (Coetia Llys)	56	14	10	0	Walker, Parker & Co.			
	Deep Level	10	12	18	6	ditto	129	5	0
	Brynford Hall	8½	12	5	6	Newton, Keates & Co.	104	6	9
	Rhosesmor	64	13	6	0	Adam Eyton	851	4	0
	Orsedd	3	13	4	0	ditto	39	12	0
	Parry's	15	13	5	0	ditto	397	10	0
	"	15	13	5	0	Walker, Parker & Co.			
	Bryn Gwiog	40	13	12	0	Adam Eyton	544	0	0
	Long Rake	20	13	7	6	Walker, Parker & Co.	267	10	0
	Holywell Level	10	15	2	0	Adam Eyton	151	0	0
	Merllyn	3½	12	6	6	A. Courage and Co.	43	2	9
	Grosvenor	4	12	14	6	Adam Eyton	50	18	0
	Lord Richard	8	12	7	6	Newton, Keates & Co.	99	0	0
	Llangynog United	33	13	3	0	Walker, Parker & Co.	433	19	0
	Lower Park	4	12	12	0	A. Courage and Co.	50	8	0
	Cefn Cilcen	4	12	15	0	Adam Eyton	51	0	0
	Mill Dam Mining Co.	36½	11	5	0	Fairburn and Ashton	418	15	0
	"	1¼	6	10	0	ditto			
" 10.	Bronfloyd	30	13	9	0	Sims, Willyams & Co.	403	10	0
	Tamar	52	21	5	0	Pontifex and Wood	1105	0	0
	Round Hill	25	13	5	6	Walker, Parker & Co.	331	17	6
	North Porthilly	7	12	17	6	Treffry's Trustees	90	2	6
	Cargoll	96	15	15	0	Sims, Willyams & Co.	1512	0	0
	Llanfyrnach	20	14	2	6	Panther Co.	282	0	0
" 11.	Chiverton	90	12	2	6	R. Michell and Son	1691	5	0
	Foxdale	100	23	8	0	Sims, Willyams & Co.	2343	0	0
" 13.	Frongoch	75	12	16	6	Panther Co.	1907	10	0
	"	75	12	17	6	ditto			
	East Darren	75	15	5	0	Sims, Willyams & Co.	1143	15	0
	Cwm Erfin	55	15	17	0	R. Michell & Son	871	15	0
" 14.	Dyliffe	72	13	5	0	Newton, Keates & Co.	1336	1	6
	"	29	13	3	6	A. Courage and Co.			
	Llanerchyraur	15	13	19	6	A. Eyton	209	12	6
	Aberdovey	12½	12	14	6	Walker, Parker & Co.	159	1	3
	Rhoswydol	9	12	10	0	Newton, Keates & Co.	112	10	0
	Creetown	6½	12	15	0	ditto	78	7	6
	"	2½	2	15	0	Walker, Parker & Co.			

THE

MINING AND SMELTING MAGAZINE.

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The Manufacture of Pig-Iron in Scotland.

(*Foundry Pig.*)

BY MM. GRUNER AND LAN.

(Abstracted from the *Annales des Mines*, 5th series, vol. xx, p. 183.)

(*Continued from page* 206.)

ECONOMICAL DIVISION.

I. *The Importance and Successive Developments of the Production of Pig-iron in Scotland.*—In order to give some idea of the successive developments of the make of pig-iron in Scotland, we must refer our readers to the table on the following page.

It appears by this table that it was between 1840 and 1845 that the make of pig-iron in Scotland entered that course of development which has been successively the means of constituting it one of the principal manufactures of Great Britain. The rapid extensions it has undergone during the last twenty years have been called forth by the increased demand of England and other foreign countries for its products, we shall see further on under what conditions and circumstances.

But before entering further into the economical question, it will not be uninteresting to remark that the progress and technical discoveries of the period from 1825 to 1835 have powerfully contributed to elevate Scotch iron-making to its present industrial position. With small coke and cold air-furnaces, with the class of coal available, and with ores of low produce, the cost of manufacture was greater in Scotland than in most other districts of the United Kingdom until about 1830; so that this country was not in a position to enter largely into the industrial movement then commencing.

The discovery of hot air, the enlargement of blast-furnaces, the substitution of raw coal for coke, the more general employment of rich ores and particularly of the *Mushet Blackband*, which had been hitherto rather neglected, were all improvements carried out from 1830 to 1835; these, reducing the cost-price of Scotch iron by from 50 to 70 per cent., placed this district, in respect of make, on an equal if not superior footing to other parts of Great-Britain. It only remained to develope the trade, and to make the most of a happy

geographical position. We shall see further on what has been done in this respect.

Periods.	Years.	Number of Blast-Furnaces. In Blast.	Out of Blast.	Total.	Yearly Production in thousands of tons.	Weekly Production per Blast-furnace in tons.
1st	1806			28	Unknown	—
	1820–3	22	—		20	17 to 18*
2nd	1827	18	6 or 7		36·5	39 to 40
	1830			27	45 to 50	—
	1833	25	2		55 to 50	42 to 43
3rd......	1839	54	—		196·56	70
	1840			64	241	72
	1845	94	—		500	102
	1846	97	25		520	106
	1847	89	43		500	108
	1848	103	36		590	110
	1849	113	31		690	117
	1850	118	—		630	107
4th......	1851	105	—		770	141
	1852	114	—		780	129
	1853	113	—		700	119
	1854	114	—		754	127
	1855	115	—		820	137
	1856	121	—		820	130
	1857	124	—		920	142
	1858	123	—		980	153
	1859	124	50		960	149

II. *Price of the Raw Materials.*—1. *Variations of the Rate of Wages.*—The price of the raw materials is very intimately connected with the rate of labour, and particularly with the daily wages of the colliers; it is therefore important to consider the fluctuations of the latter. In the following table we give the rate of wages during the period from 1848 to 1859, together with the relative prices of the pig-iron:—

Years.	1848	1849	1850	1851	1852	1853	1854	1855	1856	1857	1858	1859
Average wages in shillings and pence ..	2/7	2/6	2/9	2/6	2/7	3/3	5/-	4/4	4/3	4/-	3/-	3/3
Price per ton of Pig-iron, in shillings and pence	44/4	45/6	44/6	40/-	45/2	61/5	79/9	70/9	70/-	69/2	54/5	51/11

* The weekly production given being the mean of the whole, does not always give a true idea of the production of the most recent furnaces of each period. Thus in the 4th period, for instance, certain newly-constructed furnaces produced from 200 to 250 tons per week, while the old ones still working only gave from [illegible]0 to 110 tons.

From these figures we see, that the commercial price of the pig principally depends upon the rate of wages. Still they do not always vary in exact proportions: for example, we find that in the year 1859, the price of iron only differed 16 per cent. from that in 1852, while the rate of wages had increased 25 per cent. This is explained by the rate of production, which had increased so rapidly from 1852 to 1859, especially towards the end of that period, that it was 24 per cent. in excess in the latter year.

This rapid increase of production at a time of considerable emigration, notwithstanding the lowering of the price of pig-iron, prevented a proportionate diminution in the labour cost; thus the cost of living had increased 28 per cent. from 1852 to 1859, that is to say, more rapidly than the rate of wages; so that a workman receiving 3*s*. 3*d*. in the latter year would be worse off than with 2*s*. 7*d*. in 1852.

2. *The Price of Coal.*—It must be understood that when we speak of the price of the raw materials in what follows, we mean the cost price. The Scotch iron-works, having their own collieries and iron mines, charge no profit on their raw produce, the sale of the final products only being taken into account in showing the net result.

The conditions of working the coal having remained the same, the only difference observed between the prices of the various periods is due exclusively to the variations in the rate of wages. In 1828 and 1833 the authors of the *Voyage Métallurgique* stated the price to be 4*s*. 6*d*. to 5*s*. per ton of large furnace coal, and 1*s*. 8*d*. per ton of small; wages being 3*s*. to 4*s*. In 1845, Mr. Eckman, in a memoir published by the *Yern-Kontorets-Annaler* of Sweden (1848), gives the price of coal at 5*s*. 4*d*.; he adds, without giving the exact figures, that wages were then very low in Scotland. In 1854, Mr. Robert Hunt in his Mineral Statistics of Great Britain, states the price of large coal to be 6*s*., and the small 2*s*.; but then wages had reached their maximum, 5*s*.

The following is the average cost price for one year of one of the most favourably situated works of Lanarkshire: the seam worked was 3 to 5 inches thick; it yielded 75 per cent. of large, and 25 per cent. of small. The royalty was relatively speaking low. The average daily wages in this particular working is shown to be 3*s*. 6*d*.

	s.	*d*.
Labour (by task)	2	0
Wear and tear	0	6
Royalty	0	6
Sundries	0	1
Total	3	1

This, apportioned between ¼ of small, and ¾ of large (the latter being worth four times as much as the former) gives the following prices as shown upon the books of the works: large 4*s*. 2*d*., small 1*s*. The carriage from the pit to the furnace by the railway belonging to the mines, was 5*d*. per ton; adding this to the preceding prices, we see that the price of the coal delivered at the furnace, was for large 4*s*. 7*d*., small 1*s*. 5*d*.

It must be added that these are the minimum prices. In a great number of mines, at the same rate of wages, the cost of large

coal is at least 5*s*., and of small 1*s*. 8*d*. For the future, with the exception of a few additional pence for royalty and fluctuations in wages, the price of coal does not seem likely to vary much, at least for some time.

3. *Prices of Calcined Ores.*—The authors of the *Voyage Métallurgique* state that in 1829 and 1833 calcined ores cost 12*s*. per ton delivered at the furnace. This is also the price given for 1845 by Mr. Eckman, in the memoir already referred to. In 1854, Mr. Hunt gives it as 20*s*. The average cost per ton of calcined blackband, during the year 1859, from a working in Lanarkshire upon a pretty regular seam 12 inches thick, was 16*s*. 5*d*., apportioned in the following manner:—wages per task 8*s*. 8*d*,; royalty 3*s*.; wear and tear 1*s*. 2*d*.; carriage 1*s*. 9*d*.; sundry expenses, interest, depreciation; &c., 1*s*. 10*d*.

With wages at 3*s*. to 3*s*. 6*d*., a regular seam of this thickness would entail a cost price of 13*s*. to 14*s*. at most, since with wages at 5*s*. in 1854, the cost price was 20*s*. in similar workings, the greater number of which were certainly less favourably situated than the one we are speaking of. The 2*s*. or 3*s*. increase evidently arises from the different rates of royalty and carriage, the former having increased 1*s*. 6*d*. and the latter 1*s*. 4*d*. since 1852.

We have already stated our opinion as to the future prospects of Scotch iron-works in these respects. In the following table we give a comparison of the facts of the past and present, and a hypothetical one of the future. In the latter we have endeavoured to indicate the probable limits of future variations in the main elements of cost: in giving a higher rate to labour we do not so much take into account a rise in the rate of wages, as the greater difficulties that may be expected to arise in the working of less regular and thinner seams. It follows therefore that if wages should fluctuate, the estimated cost-price given would vary in proportion.

Elements of Cost-Price.	Past. From the Books of 1852.	Present. From the Books of 1859.	Future. Hypothetical
	s. *d*. *s*. *d*.	*s*. *d*.	*s*. *d*. *s*.
Labour	5 3·87*	8 8·25*	9 0 to 10
Royalty	1 6	3 0·94	3 0 „ 5
Carriage	0 5	1 9·01	2 0 „ 3
General Expenses	3 0 to 3 3	3 3·6	3 0 „ 4
Total per ton	10 2·87 to 10 5·87	16 9·8	17 6 „ 22

4. *Prices of the Cumberland Ores.*—Although these ores are as yet little used in the Scotch works (some furnaces only using at present $\frac{1}{6}$ to $\frac{1}{10}$ of their whole consumption), we give the prices at which they can be procured. From them it will be seen how little economy the Scotch would find in substituting these ores for their own.

* A comparison of these two figures shows that from 1852 to 1859 the difficulties of working had already increased: the rate of wages had only risen 25 per cent., while the cost of labour had increased 63 per cent. per ton.

A ton of red hematite of 40 to 50 per cent. costs 18*s*. 8*d*. delivered at the furnace, made up as follows:—price at Whitehaven 11*s*. 9*d*., carriage to the furnace 6*s*. 11*d*, total 18*s*. 8*d*.

5. *Price of Limestone and Refractory Bricks.*—The limestone quarried at distances varying from 5 to 30 miles from the furnace, costs from 3*s*. to 3*s*. 10*d*. per ton delivered, of which 1*s*. to 1*s*. 3*d*. is carriage.

It is this raw material that has fallen most in price, if we are to judge from the figures given by the authors of the *Voyage Métallurgique*, and by Mr. Eckman; the former calculating it at 7*s*. in 1833, and the latter at 6*s*. 3*d*. in 1845; Mr. Hunt states the price as 5*s*. in 1854.

Refractory bricks are divided into three classes:—

1. Furnace Bricks (special forms) per cubic foot .. .. 1*s*.
2. Refractory Bricks (first quality) per 1,000, delivered .. 42
3. Ditto (second quality) ditto 26

The price of ordinary raw refractory clay is 2*s*. 9*d*. per ton delivered at the works.

III.—*Cost Price of the Pig-Iron.*—In order to compare the economical conditions of the make of pig-iron in Scotland at the different periods mentioned, we shall give the cost price per ton of pig: 1st in 1833, 1845 and 1854, from the authors of the *Voyage Métallurgique*, and Messrs. Eckman and Hunt; 2nd in 1859–60, from our own investigations.

Elements of Cost-Price.	1833. 1st Example.				1833. 2nd Example.			
	Tons	Cwt.	*s.*	*d.*	Tons	Cwt.	*s.*	*d.*
Materials.								
Calcined Ores	1	17	22	2·4	1	18	22	9·6
Large Coal	2	2	10	6	2	0	10	0
Small Coal	1	2	1	10	0	19	1	7
Limestone	0	5½	1	11·1	—		2	6
Cost of Make.								
Labour	—		6	8·4	—		6	8
General Expenses, Interest, and Redemption of Capital	—		4	2·4	—		6	0
			47	4·3			49	9·6

Elements of Cost-Price.	1845.				1854.				1859–60.			
	Tons	Cwt.	*s.*	*d.*	Tons	Cwt.	*s.*	*d.*	Tons	Cwt	*s.*	*d.*
Materials.												
Calcined Ores	1	15	21	0	1	12	32	0	1	14½	28	11·73
Large Coal	2	0	10	8	2	5	13	6	2	2	9	8·6
Small Coal	—		1	0	0	16	1	9	0	10	0	8·5
Limestone	0	5	1	6	0	7	1	9	0	8	1	6·4
Cost of Make.												
Labour	—		2	4·75	—		5	0	—		2	9·91
General Expenses, Interest, and Redemption of Capital	—		4	11·25	—		6	4	—		4	11·68
			41	6			60	0			48	8·82

It will be clearly seen by this table that it is from the reduction of the labour cost and general expenses, that the works have hitherto maintained their cost price at much the same figure, notwithstanding the increase in the price of the ores; now the reduction in the general expenses and labour cost is due exclusively to the large daily production of the furnaces. But what we have before stated sufficiently shows that there is more probability of the cost price increasing rather than diminishing for the future.

In the actual mode of working the Scotch blast-furnaces, there is certainly room for more than one improvement: there might be a saving of a large portion of small coal for the boilers and hot-air apparatus; and while maintaining the same production as at present the consumption of large coal might be reduced. But the saving effected by these improvements could scarcely exceed 2*s*. to 3*s*. per ton, while the probable increase of from 3*s*. to 4*s*. per ton on the ore might alone raise the cost by from 6*s*. to 7*s*., perhaps 8*s*. to 9*s*. per ton.

The cost-price of 3*l*. in 1854 is evidently an exception, at least in well situated works; we have already shown a reason for this in the rate of wages at that period; we shall also see that at that date the rate of interest would be greater than at any other. On the other hand, we have hitherto chiefly considered the works most favourably situated; but there is a large number where the actual cost-price certainly reaches from 50*s*. to 55*s*., if not to near 60*s*. This seems to be particularly the case with those works trading on borrowed capital.

We might in fact quote the examples of two of these works where the cost of materials and labour amounted respectively to 46*s*. and 54*s*. per ton of pig, while the general expenses and interest, including it is true 1*s*. to 2*s*. carriage to Glasgow, amounted to 6*s*. 8*d*. which brought the total cost to 52*s*. 8*d*. and 61*s*. 2*d*. It must be observed that these figures refer to the year 1857, when wages were 4*s*. instead of 3*s*. 3*d*. to 3*s*. 6*d*. in 1859–60.

From this it would seem that the banks charge a high rate of interest; but it is evidently difficult to obtain precise information on this point. At the same time the facility with which the Scotch manufacturers obtain cash for their products, owing to the system of *warrants*, places them in this respect in a relatively advantageous position. As a consequence of this system, there is naturally in Scotland a more intimate connection between the charges for interest and the current rate of discount, than in the other iron districts of the United Kingdom. In default of precise data as to these charges for interest it may be well to give the variations of the rate of discount during the period from 1848 to 1859.

Years.	Rate of Discount per 100.	Years.	Rate of Discount per 100.	Years.	Rate of Discount per 100.
1848 ..	3¾	1852 ..	2½	1856 ..	5¾
1849 ..	3	1853 ..	3½	1857 ..	6½
1850 ..	3	1854 ..	5	1858 ..	3
1851 ..	4	1855 ..	5	1859 ..	3¼

In comparing this table with that of wages and prices of the iron, (see *ante* p. 322), it will be observed that the rate of discount varies almost proportionately with them. That is to say that ordinarily, *Capital* and labour divide the profits of the manufacture, the one having no advantage over the other except accidentally.

Before proceeding to the subject of sales and markets, it must be remembered that to the cost-price given above, must be added 1*s*. to 2*s*., according to the position of the works, for carriage by canal or railway to the general depôt at Glasgow.

IV. *Markets and Sale of Products. Price of Pig-Iron.—Profits of the Makers.*—1. *Markets and Variation of Prices.*—As regards the sale and export of their products, it must be borne in mind that the Scotch works are in an exceptionably favourable situation. They possess at short distances two coasts abounding in ports, with which they are connected by numerous means of transport—railways and canals; they are also close to two rivers—the Clyde and the Forth, both navigable for a large part of their course. Scotch industry did not, however, learn till late to make the most of these natural advantages, and to make the export of its iron one of the most essential elements of its commerce.

From 1830 to 1845, the Scotch makers seem to have had no other object in view than the home consumption of the United Kingdom. Thus in 1830, out of a total production of 40,000 to 50,000 tons the exports were only 8,000 to 9,000, of which almost half went to France.* In 1845, out of a production of 500,000 tons the exports were only 54,761, that is to say a little more than $\frac{1}{10}$—a less proportion than in 1830.

During all the former period the progress of production kept pace with the local consumption and with the coasting trade of Great Britain: this was the period of great railway speculations, and of the completion of the principal English lines. Thus the home demand easily absorbed the additional production; stocks were rare at the works; and continually rising prices led to the establishment of new works, to which an almost virgin coal-formation seemed to allow an indefinite scope.

Towards the end of this period the increased number of works, and consequently a more active competition, coupled with a now more restricted home-market, caused the first fall in prices, as will be seen by the following table :—

Years.	Selling Price.	Years.	Selling Price.	Years.	Selling Price.
	£ *s*. *d*.		£ *s*. *d*.		£ *s*. *d*.
1830 ..	5 0 0	1835 ..	4 10 0	1840 ..	3 15 0
1831 ..	4 10 0	1836 ..	6 15 0	1841 ..	3 0 0
1832 ..	4 10 0	1837 ..	4 10 0	1842 ..	2 10 0
1833 ..	4 0 0	1838 ..	4 0 0	1843 ..	2 16 0
1834 ..	4 5 0	1839 ..	4 10 0	1844 ..	2 14 9

* For this part of our economical division we have had recourse to: 1st, a small pamphlet by Mr. John Barclay, published at Glasgow in 1850, called *Statistics of the Scotch Iron Trade;* 2nd, to the *Mining Records* of Mr. Robert Hunt; 3rd, to the numerous circulars and price-lists of the various commercial *houses of Glasgow,* collected by ourselves.

In 1845-6 a new era opened for this branch of Scotch industry: it extended itself to foreign countries, seeking in France, in Germany, and in the United States, markets which rapidly increased from 1846 to 1848. This latter year, in Scotland as elsewhere, was marked, by an epoch of general disturbance in industrial and commercial affairs; and this district therefore, like many others, had to undergo the long crisis of 1848 to 1852, a crisis still more aggravated in its case by the competition of those new establishments which were in course of erection at the eve of that calamitous period.

In 1852–3 this industry at length recovered itself. The Scotch works obtained a large portion of the supply required by the great public works then being carried on upon the Continent and in America. Stocks were reduced, and prices, without reaching the high rates of former times which competition for the future renders impossible continually rose until 1857. The crisis then taking place in America coinciding with a check of the great enterprises of the Continent, seemed to unite in the early part of 1858, in terminating this period of prosperity; and the political preoccupations of Europe have contributed to perpetuate it to 1859 and 1860.

This period of dulness has been still more specially aggravated in the case of the Scotch works, by the competition of the completely new district of Cleveland, which has increased so rapidly during the last few years. The cost prices and selling prices are sufficiently low in this district to compensate for the slight difference in quality which is alleged to exist between its foundry-pig and that of Scotland. The following table shows the fluctuations of stock, of exportation of prices from 1845, to 1859.

Years.	Stock.	Exports. Proper.	Exports. Coasting.	Total Exports.	Selling Price of the Pig-iron.
	Tons.	Tons.	Tons.	Tons.	£ s. d.
1845	240,000	56,671	—	—	4 0 3
1846	144,000	119,107	192,893	312,000	3 11 9
1847	89,000	143,460	227,005	370,465	3 5 0
1848 ..	80 to 100,000	162,114	227,870	389,984	2 4 4
1849	196,000	153,200	221,943	375,143	2 6 1
1850	200,000	134,710	189,490	324,200	2 4 6
1851	300,000	192,610	260,090	452,700	2 1 0
1852	360,000	224,370	210,530	434,900	2 5 2
1853	450,000	318,020	316,980	635,000	3 1 5
1854	216,000	283,903	301,097	585,000	3 19 0
1855	132,000	243,108	295,000	538,108	3 10 9
1856	130,000	258,589	245,000	503,589	3 12 6
1857	90,000	294,232	233,768	528,000	3 9 2
1858	196,000	274,000	280,000	554,000	2 14 5
1859	350,000	254,245	312,755	567,000	2 11 11

We should give but an incomplete idea of the commercial position of Scotch iron if we did not add a few words on the local consumption, which is divided into two branches, *second fusion foundry-pig*, and *forge-pig*. The following shows the quantities of the two kinds of consumption during the period from 1845 to 1859.

Years.	Foundry Consumption. (In thousands of tons.)	Forge Consumption. (In thousands of tons.)	Total Consumption. (In thousands of tons.)
1845	—	60	—
1846	200	80	280
1847	—	100	—
1848	—	130	—
1849	117	110	227
1850	—	—	—
1851	—	—	—
1852	—	—	—
1853	125	180	305
1854	111	150	261
1855	125	175	300
1856	133	193	326
1857	155	160	315
1858	146	132	278
1859	193	150	343

It seems thus that the quantity of pig-iron used in second fusion and in the forges has not increased in the same rapid ratio as that exported; but it must be observed that a large portion of the foundry-pig is designed for export. Besides, 25 to 30 per cent. of the bar and sheet iron manufactured in Scotland is sent direct to foreign countries. As regards the surplus of the foundry-pig and manufactured iron, a large proportion of it is absorbed by the works of the Clyde and Forth in the construction of vessels, iron bridges, and various machinery for England and foreign countries. In a word, since 1845–46, Scotland has made the most of the natural advantages of its geographical position, and at present exports the greater portion of its siderurgical products.

2. *Mode of Sale.*—Most of the makers have a special broker who receives and executes the commercial orders; but these orders almost always reach him through the intervention of numerous commission houses established in Glasgow and foreign countries. It may be remarked as worthy of notice that it is to Germany that Scotland principally owes this colony of brokers, to whom there is no doubt it is indebted for a great part of its commercial activity. In times of prosperity as well as at a crisis these brokers are ever in search of new markets—always attentive to whatever may help to extend their relations over various parts of the globe.

The system of *warrants* on the stocks of pig-iron at the general depôt at Glasgow, in furnishing continual food for speculation, has the effect of increasing the activity of these brokers by making them the natural medium between the makers and Scotch and foreign speculators.

3. *Profits of the Makers.*—In order to have an idea of the profits of the makers it will be necessary to give a short *résumé* of what precedes respecting the variations in the selling price and cost-price. By collating the various facts we have given on this subject, we see that:—

(1.) As long as Scotch iron making, with little competition, only had in view the home market, it easily maintained a selling price of

4*l.* to 5*l.*, against a cost-price of 2*l.* to 2*l.* 10*s.* In a word great profits were realised with a comparatively restricted production.

(2.) The splendid fortunes made during this first prosperous period gave rise to the erection of a number of works disproportioned to the permanent wants of the home market.

(3.) It is thus owing to the exclusive influence of competition that the Scotch makers have been obliged to extend their operations from the home to foreign markets.

(4.) This commercial revolution corresponds with an important modification in the management of Scotch works. Subject at this time to low prices, they sought a compensation for their small profits in an increased production and in the elasticity of the market. It was at this date in fact that the rapid increase in the daily production of the blast-furnaces commenced; an increase which resulted in a total production in 1859 double to that of 1845, and five times as much as that of 1830 to 1840. The number of furnaces however at these three periods did not increase in the same ratio, for they remained as 1·33 : 1 : 0·66. The question is: Have the makers found a perfect compensation for low prices in increased production? It would be scarcely correct to say so absolutely; but it is easy to see that these modifications have procured them important advantages.

In the first place we have shown that notwithstanding the increased price of the raw materials, the large daily production has kept the cost price much the same with the same rate of wages. On the other hand if, during the period from 1845 to 1859, the selling prices have always been lower than those of 1830 to 1840, they have still risen sufficiently high at times, to allow about the same profit to each furnace as in former periods. To be convinced it will be sufficient to compare the cost-price, 3*l.* in 1854, with the selling-price of the same year, 3*l.* 19*s.* Thus a furnace producing 6,000 to 7,000 tons at a profit of 19*s.* per ton, realised an annual profit of 6,000*l.* Now in 1830 to 1840, with a difference of 2*l.* to 2*l.* 10*s.* between the selling and cost-price, a furnace producing a maximum of 3,000 tons, only realised an annual profit of 6,000*l.* to 7,500*l.* Thus it will be seen how much the definitive results are alike, *cæteris paribus*.

It is true that the selling price only once reached 3*l.* 19*s.* in 1854; fluctuating more generally between 3*l.* and 3*l.* 5*s.* But on referring to what has been said on the variations in the rate of wages, it will be seen that the cost-price was generally under that of 1854 3*l.* Still, even taking these variations into account, if we simply compared the cost with the selling price for one year—say 1859—it would appear that even the works most favourably situated only realise a profit of 1*s.*, 2*s.*, or 3*s.* per ton.; that is to say that notwithstanding their large production they worked on the verge of profit and loss.

This is what appears at first sight; but there are also circumstances which do not appear, without a more careful examination of the facts.

Thus in looking closely at the figures of the productions for 1845 to 1859, we shall be struck by the sudden starts which appear in the

onward advance from one portion to another of this long period. Thus from 1845 to 1848 the increase was only 18 per cent.; from 1851 to 1854 *nil.;* from 1854 to 1857 22 per cent.; while from 1848 to 1851 it was 30 per cent. That is to say that at the periods of lowest prices and largest stocks, there was the most rapid production, the same seems to have been the case since 1857.

The explanation of this is very simple. Those makers who possessed large capitals profited by a low rate of wages, caused by high stocks and low prices, in order to push their production, and to make at a reduced cost, products which they could dispose of in better times. They thus often realised greater profits than appears by a mere comparison of the cost and selling price for any one year.

Establishments with smaller capitals found in the system of warrants a rarely failing resource. Except in the case of a general and prolonged crisis, warrants always find purchasers at periods of low prices and high stocks, periods which, as we have already seen, almost always correspond with a low rate of discount or in other words an abundance of money. Products whose realisation at a profit is a question of time pass naturally at such periods from the maker to the capitalist or speculator, and the former is thus able to pass through a period of difficulty.

4. *Real Influence of Stock.*—The comparisons which we have given show the real effect of stocks, which have often been held up as a permanent danger of competition at any price; but if to any one it is a menace more to the Scotch workmen than to the foreign competitors of Scotch iron. In support of this fear of stocks, their danger in times of crisis is dwelt upon. But do not the facts from 1848 to 1853,—a crisis certainly sufficiently long and sufficiently intense,—show that these fears are gratuitous! At the beginning of this period there was already a stock of pig-iron; now far from this being sold at any price, we see that it rapidly increased from 80,000 or 100,000 tons in 1848 to 450,000 tons in 1853. A sufficient proof of the determination of the Scotch makers and merchants not to lower the selling price below the cost-price.

As regards the speculations by which the Scotch makers maintain and develope their production at times of crisis, they are certainly facilitated by the nature of the product itself, which, being always alike and of a simple and unchangeable classification, the commercial transactions connected with it are very simple, and require little special knowledge. Still it requires a good deal of capital. In this respect it may be said that the greater part of the present Scotch resources are the result of a former period of prosperity. The earlier profits were not concentrated in a few hands, they were distributed among a great number, who continued to apply them to the same business. This continual application of capital to the same purpose, is one of the most striking characteristics of this industry not only in Scotland but also throughout the United Kingdom.

It must be remembered that the confidence which sustains the *warrants* and the speculations to which they give rise derives its greatest support from the vast market which reduced prices have opened to Scotch pig-iron. This confidence can only be shaken

by the appearance of products equal to those of Scotland and at a lower price.

Without wishing to prophesy, we think that the Scotch cost-prices are more likely to increase than diminish, for reasons we have sufficiently explained. If Cleveland on the one side and the works recently projected in Lancashire and Cumberland on the other, continue to increase under new, and therefore more favourable conditions, Scotland will certainly be exposed to serious competition, and its exports of raw pig or foundry-pig subject to inevitable reduction.

But as regards stocks and speculation, Scotch industry has certainly not to fear, from this future competition, such unexpected results as not to give it time to prepare for the change. Abundantly provided with raw materials, it may then have recourse to the resource of those districts which, unable to produce simple products at a low price, find in an elaborate and complete manufacture the utilisation of their natural riches. In this respect Scotland seems to us as much, if not more, adapted than Staffordshire, Yorkshire, or Wales, for the manufacture of all kinds of iron, both as regards quality and cost-price.

The Seton Mining District.

BY THE EDITOR.

(*Continued from page* 284.)

As will be seen by Plate II (in our last number) Wheal Seton is adjoined on the west by WEST SETON in the lands of Mr. Basset.

The original operations on this sett were commenced about 150 fathoms to the north of the present workings, which position was pitched upon as being on a line with the original bearing of the Great Caunter lode. A reference to Fig. 7, Plate II, will show how this occurred, for the bearing of the Caunter lode in the eastern part of Wheal Seton indicated a direction shown by the dotted line $x\ y$ in plan: the change of the bearing of this lode in the western part of the latter mine had not then been ascertained. These northern workings were prosecuted to the depth of about 30 fathoms and are now abandoned: they are communicated with the present mine by a cross-cut at the 56.

The principal workings in West Seton, and the great bunch of ore, have been in the eastern part of the sett, not far from Wheal Seton boundary. The present engine shaft, as shown in transverse section, Fig. 4, is sunk vertical to the 18 under adit (22 fathoms from surface), below which it is sunk on the course of the lode to the 46. Here, as seen by the transverse section, the lode divides into two—the Old North lode, which continues above the elvan with its great underlie, and the new South lode, which drops down through the elvan much more vertically: the present shaft is continued on the South lode, which has been the productive one, and from which cross-cuts have

been driven at the lower levels to the Old North lode. On this shaft there is an 85" pumping engine which came from Tresavean, and which has been up about three years. Before the erection of this, the mine was sunk and drained by flat-rods from the engine erected on the original northern workings already referred to. At present all the water is heaved to surface by six plunger-lifts—three 14" poles above the 56, and three 11" poles below the 56.

The full particulars of the workings of an extensive mine like West Seton, would extend this article to a greater length than our space permits; so that on the present occasion I shall confine myself to the more general features of interest. The first feature most worthy of notice is the great underlie of the lode in the upper levels —and indeed of the Old North lode to the deepest points explored. This, taken in connection with the extremely unpromising look of the lode at the adit, and in the upper levels, will account for the peculiar disfavour with which this sett was long regarded by the most eminent mining authorities in West Cornwall. The existence of these lodes had been known for a very lengthened period, having been cut in driving up the Roskear and Dolcoath adit from the Red River; but the sett was more than once rejected by persons of the greatest judgment. It is next noticeable that *above the elvan* the lode never made rich: it was only after the South lode had passed through and got *under the elvan* that it became richly productive. The Old North lode, which continues to go down above the elvan, has indeed produced some bunches of ore and has altogether probably about paid its expenses; but the riches of West Seton have been on the South lode *under the elvan*. In looking at the position of New Seton presently, we shall again refer to this point.

The great run of ore ground on the South lode was first cut at the 82 in the cross-cut from the Old North lode. The course of ore was from 6 to 7 feet wide at this level, but considerably increased in value downwards, the heart of the bunch being met with a little under the 90, where there was a lode for some fathoms long which turned out 26 tons per fathom of ore worth 10*l.* per ton. At the latter level there was a lode for some considerable length worth from 140*l.* to 150*l.* per fathom. The ore made down to the 110, below which level the lode has fallen off. The engine shaft has been sunk two levels below this, and is now sinking below the 130 by 8 men and 4 boys at 30*l.* per fathom. The two bottom levels—the 120 and the 130—have been producing some time. In the 120 west the lode is 8 feet wide and produces tin-stuff yielding 14 lbs. per ton, valued at 18*l.* per fathom: driving by six men at 14*l.*, with a branch of ore in the bottom of the level. In the 120 east the lode is from 4 to 5 feet wide, tinny, yielding one ton of ore per fathom, valued at 12*l.*, and driving by 4 men at 14*l.* In the 130 the level east is only driven a couple of fathoms and is poor; but west it has been extended about 14 fathoms, and has produced good stones of ore: the lode in the present end is 5 feet wide producing a little tin—driving by 4 men at 17*l.* From the 120 a cross-cut is being driven north, to try for the north part of the South lode which has been worked in the levels above: although the end has been driven five fathoms nothing has yet been met with.

The 110 is still opening out valuable ore-ground. The western end has recently considerably improved and is now worth seven tons to the fathom being the best end in the mine: driving by four men at 16*l*. It will be seen by the section that this end is approaching the cross-course. At the back of this level, towards the shaft, there is a fine stope working by four men at 10*s*. per ton—the lode being 11 feet wide and worth from 18 to 20 tons per fathom. In the 110 east of the shaft the lode is in two parts, about five fathoms asunder at the present ends—the north part bearing E. 15° N., and the south part E. 2° S. The end on the north part is worth two tons of ore per fathom, driving by four men at 11*l*. 10*s*.: this end is about 20 fathoms from Wheal Seton boundary. About two-thirds of the distance from the shaft to the end a winze is sinking (now down about four fathoms) to come down on the 120 east: the load in this winze is worth two tons per fathom. The 110 on the south part, to which a winze has been communicated from the 100, is not productive.

At the 110 a cross-cut has been driven north 42 fathoms, to the Old North lode which has been opened on two fathoms each way. In this cross-cut the elvan was found to be six fathoms wide, worth from two to three fathoms of killas between it and the lode. This is the lowest point at which the Old North lode has been seen, and its prospects here are not such as to encourage deeper explorations, at least at present.

At the 100 several ends are driving. The 100 west on the South lode is worth ten cwts. per fathom, and being now in cross-course: driving by two men at 12*l*. In this level east of shaft the lode is in four parts. The 100 east on the South part is worth three tons per fathom, driving by four men at 11*l*.: eight fathoms behind this end a winze is sinking. The 100 east on the north part is worth one ton per fathom, driving by four men at 10*l*. These north and south parts have the same respective bearing in this level as in the 110.

In the cross-cut north at the 100, 15 fathoms west of engine shaft a branch was cut about 15 fathoms north of the South lode, worth in the bottom of the level 40*l*. per fathom, but it did not hold for any considerable distance: a winze has been sunk to the 110, and a pitch is now working at 12*s*. in the 1*l*. On the Old North lode (which here bears E. 10° N.) the 100 east has been driven by two men at 7*l*.: this end, the only one now driving on the Old North lode, is poor, and this lode has altogether fallen off from the 90.

At the 100, 10 feet to the south of the South lode the New South lode has been opened on, 37 fathoms west of shaft. This end is now worth two tons driving by two men at 8*l*.

The 90 fathom level has been driven east nearly to Wheal Seton boundary. On the north part the end is poor; but five fathoms back from the end a winze is sinking by two men at 7*l*., worth one-and-a-half tons per fathom: this winze is going down on the back by the 100 which is worth three tons per fathom and is set on tribute at 6*s*. 8*d*. The 90 east on the south part is within two fathoms of Wheal Seton boundary: the 100 from Seton is here back to the boundary, but in consequence of one calculating on the underlie and the other vertically, this 100 is some fathoms above the 90 from

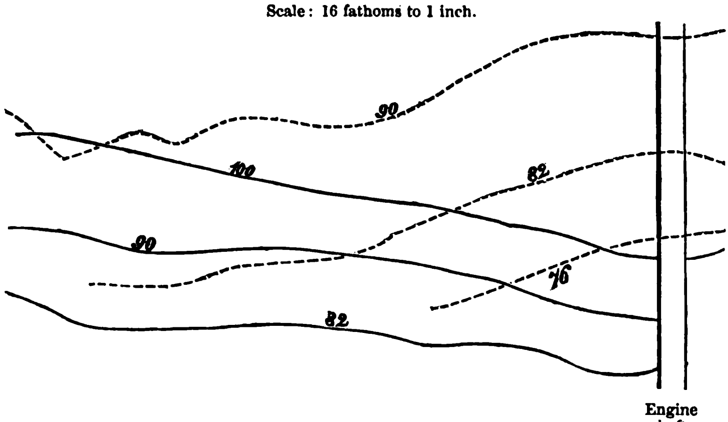
West Seton. The 90 end where stopped is worth 50*l.* per fathom; and behind this a stope is working by six men at 22*s.* per ton. The 90 west is worth two tons per fathom.

At the 70 a branch from the South lode went off north—between the lode and the elvan—called the North lode, on which a shaft was sunk for some way. This lode was at one time productive, but has now fallen off.

The operations in the western part of the sett, about the new shaft, are of very great interest. Taking the bearing of the Old North and South lodes, west of the engine shaft, we find them converging together westward, at an angle of about 18°; the Old North lode bearing W. 13° S., and the South lode W. 5° N. This will be best shown by the accompanying sketch, Fig. 1, in which the dotted lines show the levels on the Old North lode, and the continuous lines those on the South lode:—

Fig. 1.

Scale: 16 fathoms to 1 inch.



Whether these lodes absolutely come together westward or not, cannot be as yet decided; but the lode hitherto seen in this part of the mine seems, from its great underlie and general appearance, to be the Old North lode. Strange to say the elvan here seems also to be wanting, or at least reduced to a very small size, although we again find it in full force westward at New Seton. The 56 from engine shaft on the South lode, starting just under the elvan, is driven west to the new shaft; and in this course it seems to have passed from the one lode to the other. This new shaft is now down 17 fathoms below the 56 on the course of the lode; which underlies 5 feet per fathom—so much that no ladder-road is required. The 76 is driven west to within two fathoms of this shaft; but there will be about 12 fathoms more to sink to hole to this level, on account of the great underlie. The lode in this shaft varies from one to four feet wide, with stones of ore.

About 35 fathoms west of the new shaft, a winze is sinking below the 28, on a large lode of spar and jack five feet wide, with stones of ore. The lode here also underlies five feet; and the 42, west of new

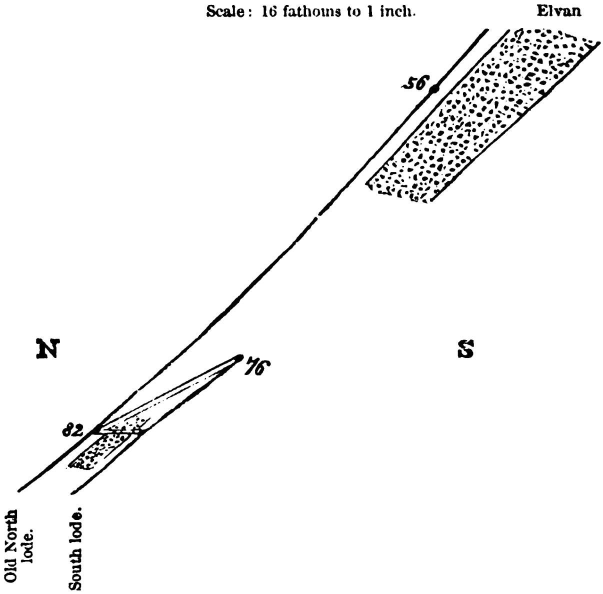
shaft is driving to meet this winze: this end is now driven about 15 fathoms from shaft, in a lode three feet wide, poor and underlying very fast. The 28 end, west of new shaft (which is the most western end in the mine), is about 10 fathoms in advance of this winze: end poor, and at present suspended to facilitate sinking of winze.

In the western part of the mine, a cross-cut is being driven south at the 56 on the cross-course, with the object of intersecting a south lode now working in North Roskear. This cross-cut has been driven about 40 fathoms, and about 20 fathoms more remain to drive to cut the lode: no elvan has been met with in this cross-cut. On the same cross-course another cross-cut is being driven at the 90 with the same object.

In this part of the mine, what is supposed to be the Old North lode was seen in the 56, to the north of the elvan which is here eight fathoms wide. At the 76 a level was driven which is supposed to be on the South lode: below this a winze was sunk, which however holed to the South lode at the 82. At this latter level a cross-cut was driven south, to intersect the South lode, which was done in four fathoms driving; the elvan here being found to be but three fathoms wide. The accompanying sketch in Fig. 1, will show their position:—

Fig. 2.

Scale: 16 fathoms to 1 inch.



West Seton has been the best modern copper mine in West Cornwall, and has already dividend nearly 120,000*l*. net profit after deducting calls among the adventurers. The following most interesting and lucid statement of the progress of this mine has been recently issued to the adventurers by the purser, Mr. Benjamin Matthews:—

THE RISE AND PROGRESS OF WEST WHEAL SETON.

From the commencement of the Mine (being May, 1844) down to the end of April, 1862.

	£	s.	d.	£	s.	d.
The total cost from the commencement down to the end of April, 1853, is	..	..		37,214	9	6
This cost was met by calls to the 24th February, 1845, inclusive, of	1,400	0	0			
Calls to the 1st January, 1846, inclusive.. ..	900	0	0			
„ 5th April, 1847 „	3,400	0	0			
„ 28th March, 1848 „	4,200	0	0			
„ 27th „ 1849 „	2,700	0	0			
„ 26th „ 1850 „	800	0	0			
„ 31st „ 1851 „	2,400	0	0			
„ 30th „ 1852 „	2,000	0	0			
„ 29th Nov., 1852 „	1,200	0	0			
	19,000	0	0			
and by sales of copper ores, less dues, from the 12th October, 1848, (the first sale) down to the 7th April, 1853, to	17,280	14	1			
	36,280	14	1			
Since the end of April, 1853, the further costs, to end April, 1862, have been	..	..		143,976	2	7
				181,190	12	1
and the sales of copper ores, and other ores, down to the 14th June, 1862, less dues, have been	282,784	13	1			
	£319,065	7	2			
the difference has been paid by dividends, to the 17th June, 1862	..	..		137,000	0	0
and a balance in favour of the adventurers, to end April, 1862, of	..	..		874	15	1
				£319,065	7	2
By the above statement it will be seen that the net proceeds of the mine, less dues, amount to				300,065	7	2
and the lord has been paid dues				21,432	16	10
Total proceeds of the mine				£321,498	4	0
The total costs of the mine, as shown above, to end April, 1862, is..				181,190	12	1
Dividends paid £137,000, less calls of £19,000, showing a net profit of				118,000	0	0
Balance undivided to end April				874	15	0
				£300,065	7	2

Thus the net profit is nearly 8*s*. in the £, and in addition to the net profit of £118,874 15*s*. 1*d*., are the machinery and plant on the mine.

				£	s.	d.
The dividends of the 1st year, ending April,	1855,	were	..	6,000	0	0
„ 2nd „ „	1856,	„	..	11,200	0	0
„ 3rd „ „	1857,	„	..	14,800	0	0
„ 4th „ „	1858,	„	..	18,800	0	0
„ 5th „ „	1859,	„	..	17,400	0	0
„ 6th „ „	1860,	„	..	26,200	0	0
„ 7th „ „	1861,	„	..	24,600	0	0
„ 8th „ „	1862,	„	..	18,000	0	0
				£137,000	0	0

Although the bottom levels in West Seton are comparatively poor, the rich ore-ground having cut out at the 110, the prospects of the mine remaining a permanently profitable one are not seriously impaired. The great resources of this district—a district unequalled in the world for its production of the ordinary metalliferous ores—gives us a confidence in the future which no other district in the United Kingdom can inspire. In Wheal Seton the great course of ore cut out at a similar depth; but after an interval of a couple of poor levels, another rich shoot of ore-ground has been met with, on the lode entering the greenstone. A glance at the section in Plate II will show as how this has occurred; and there is no reason why a similar result should not be anticipated in West Seton. However this may be, the result of the explorations in this lode in depth, in North Crofty and Wheal Crofty, show that it possesses resources, the development of which is only a question of time. In the old workings of those mines the deep-lying resources of the district were less understood, and consequently during the period of their richness the operations in depth were not prosecuted with a vigour which our present knowledge would have induced. The rich shallow deposits were worked away, and it was left to a future period of poverty to sink the mine. In West Seton however this is different; and the deep explorations are now being pushed on without delay, with all vigour, while the rich upper ore-deposits are yet available to carry out this work without dipping into the pockets of the adventurers.

Besides the prospects of the future of the mine in depth, there is a large extent of high ground still to explore—particularly westward. Recently the prospects of the mine in this respect have much improved, and the improvement of the 110 west to 7 tons per fathom is particularly cheering. The uncertainty with regard to the lodes in the western part of the mine may be confined to the upper levels: in depth it may be found that the position of the South lode is equally well defined as in the eastern part of the mine. This is probable, as in North Roskear, which is parallel, there has been a decided western dip of the ore.

Besides the lodes in the run of the Great Caunter there are several others north and south of it—all excellent speculations—which may some day turn out of importance. West Seton is under the management of Captain Charles Thomas, of Dolcoath, and is held by one of the best set of shareholders in the county. The principal resident agent is Captain Malachi Bath, who has also the management of New Seton and South Seton: the other underground agent is Captain John Jennings, son of the late manager.

The position of New Seton with respect to West Seton is best shown on the section given in Plate II. It formerly formed part of course West Seton sett, but was divided off, and put to work separately, at the suggestion of Mr. Basset's agent—the shares being offered, of *pro rata*, to the West Seton adventurers: so that, to a great extent, the principal shareholders in both mines are identical.

The workings on this sett are as yet inconsiderable. The adit comes in the 16 fathoms deep, and below this the shaft goes vertical to the 14, after which it is sunk on the course of the lode, which, like the Old North lode in West Seton, underlies 5 feet in a fathom

north over the elvan. The lode is large, and fine rocks of ore have been met with in the shaft, and in the 52; but as yet nothing permanent. Our readers will bear in mind that in West Seton no important discovery was made until the South lode dropped through the elvan.

Mr. Benjamin Matthews, of St. Day, is the purser of New Seton as well as West Seton. The engine here is a 45"—the same that was on the Old North workings at West Seton.

East Caradon and "Sensation" Mines.

WITHIN the last few weeks the world of London mine share-brokers and share-speculators has been agitated to its centre about the fluctuations in East Caradon shares. As agitations of this kind are of periodical and by no means unfrequent occurrence—and as their continuance is generally about as evanescent as their objects are worthless—matters of the kind may be considered as scarcely worthy of serious comment. But as the present agitation and its object are not of a common order, and the whole matter involves questions of the most vital importance to the well-being of metallic mining, it seems to us worth while briefly to review the questions in controversy.

Under the most happy circumstances, and under the best management, metallic mining is essentially speculative in the cases of individual mines. Taking, however, the best districts as a whole the result will show very large balances of profit; for brilliant mining successes can find no parallel, in their ratio of profit, in any other industrial pursuit. It is impossible even to imagine any other case where—as in the instance of Devon Consols—the investment of 1,000*l*. can give immediate and long continued profits at the rate of from 50,000*l*. to 60,000*l*. a year. A business where results like these, although not common are yet possible, can afford to meet with heavy losses, and yet show a large balance of profit; and this is the case with respectable and judiciously managed metallic mining. Of course in a speculative pursuit like this, which appeals to those gambling propensities that seem to be deeply engrafted in human nature, there is a class of mining conducted in a reckless and gambling spirit whose result, almost without exception, is one of unredeemed failure. Metallic mining as a whole, however, can no more be fairly held responsible for the disasters which necessarily follow this class of mining, than banking can be held responsible for the losses incurred in such cases as Strahan, Paul, and Co., or the Royal British Bank. The public opinion of the metallic mining districts utterly disavows this class of mining, which is supported by—and indeed owes its existence to—the unreasoning credulity and cupidity of London or "outside" speculators.

Metallic mining being thus necessarily speculative in the case of individual mines, of course those who adventure in them must be prepared—that is if they are reasonable men—to incur losses even where

they hoped for the greatest success. No doubt we see in prospectuses, and in the advertisements or circulars of brokers, statements, that such and such concerns are certainties—beyond the range of mining contingencies; but this even the most credulous must see to be a mere impudent misstatement—a highly seasoned bait to catch the lowest and least intelligent among those who speculate even in "outside" mines. What the chances or prospects may be in the case of each mining adventure must consequently be a matter of opinion, upon which even those who are most competent to judge may frequently be expected to differ. Among the leading miners of our principal districts, however, there are certain doctrines accepted—as resulting from the experience of ages—which, although they are incapable of scientific definition, are yet of daily application; and which reduce mining speculation within certain recognised limits of of certainty. As Captain Charles Thomas has forcibly remarked, if we do not know where ore *is*, we at least approximately know where it *is not*: if we are not in a position to say—There is a rich mine in such and such a place, we can in certain places say —There is but little chance of one here.

Ordinary mining adventure is thus a matter of opinion within certain recognised limits, outside of which failure becomes a matter of course; and those who speculate in mines must be prepared to meet with losses in individual cases, although, if they distribute their risk judiciously, they ought on the whole to make large profits. In a matter where mere opinion enters so largely, and where the limits within which success is possible are so incapable of definition, it is natural that unprincipled persons should seize upon it as offering the widest and safest field, in which to appeal to the ignorance and cupidity of small speculators. There are a large number of mines concocted every year, the object of the promotors of which—like Sam Slick's nutmegs—is to "sell:" the mining is merely nominal, just sufficient to give the concern a legal existence. With such things, and their victims, experience has shown us it is useless to meddle: they always have existed and always will exist, but have as little connection with real mining as Colonel Sleigh's bank in the Haymarket had with the Bank of England.

It is not however with these mock mines that we have at present to deal. Our object is to refer to the action of the London share market on mines which are in every respect fair and legitimate speculations, and sometimes even splendid successes; but which, from the peculiar manner they are manipulated, have been made a source of heavy loss and grievous injury to sound mining enterprise.

The evil of which we complain is of comparatively recent growth, as is indeed the mine share market itself—so much so that many of us have scarcely yet realised its action. Still this action is abundantly simple. Instead of acting simply as brokers, and recommending their clients to invest in what they consider most advisable in the whole range of mining adventure, it has now become the regular practice for the brokers to combine in certain cliques, for the purpose of working up to fabulous prices two or three certain mines at a time, in which they—by themselves or friends—have secured a sufficiently preponderating influence to make it worth their while

to do so. They endeavour to divert all the capital flowing into mining for a certain time into these two or three channels; and if they only very partially succeed, the result is that the favourite mines of the hour are worked up to enormous prices. A little consideration will show how sound their calculation is. If we take any one or two mines, it is at once evident that even one-half of them is but a trifle, if the smallest modicum of the great floating wealth of England is diverted towards them: if only one person in each of our large towns were induced to buy shares, an enormous enhancement of price must follow.

As far as the brokers are concerned it may be admitted that this system, for the time at least, is a monstrously successful one; and as a matter of fact large sums of money have been made by it very recently. In the interest of the public however who wish to invest in mines; still more in the interest of mining; and even we believe in the ultimate interest of the brokers themselves—the policy is a fatal one, and consequently we have no hesitation, as far as we are concerned, in entering against it our most energetic protest—although in doing so we may bring down upon our heads the opposition and abuse of those interested in maintaining the present system.

A "sensation" mine—which is the most characteristic epithet we can find to describe concerns promoted to this class—is generally selected with a certain amount of judgment, and is usually in itself a very good speculation or a prosperous success. There is rarely any objection to it in itself, and consequently there is no difficulty in obtaining favourable reports of it from the most respectable agents. The purpose is not to sell a worthless thing for a considerable sum of money—that is left to mere outsiders: the object is to sell a thing which really possesses merits and has a certain definite value, for two or three times that value—which is a much safer and more plausible policy, but one which results in almost as much loss to the buyer.

"Sensation" mines are of all classes—from the newly-granted sett on which the sod is scarcely turned, to some of the best dividend mines in the kingdom—in the latter case as in the former the object being to create by every known means of puffing and exaltation, such an excitement as shall work up the shares to double their intrinsic value. Scores of mines of these and every intermediate class, have in turn occupied the conspicuous but scarcely enviable favour of the brokers. North Pool, East Russell, North Bassett, Lady Bertha, although belonging to such very different categories, have each in their turn occupied the position of "sensation" mines—and have been consequently worked to prices which neither their prospects nor their profits ever justified. It is a remarkable fact, but one nevertheless true, that since the prices of mines have been regulated by the operations of brokers, there has been more money lost by the public in dividend mines in the best districts in Cornwall than by the mining failures in those same districts. Wheal Buller, the greatest copper discovery in Cornwall during the present generation, was productive of more loss to those who bought the shares at the high prices to which they were worked, than any mining failure in the same locality.

If there have been "sensation" mines in West Cornwall—which has certainly been the case—it has been on a very small scale compared with the eastern districts. To Tavistock we believe is due the honour of inaugurating the system, which certainly flourished there in its vigorous youthfulness, with a life and energy which has not been approached until the recent exaltation of the Caradon district. In this latter district South Caradon has been a splend.d mine for years; but then South Caradon is a mine beyond and above brokers, and we should have heard little of this district in the world of Spread Eagle Court, were it not for the happy discovery of a mine which, from its character, and the manner in which it was held, was above all others the most suitable for taking the post of the "sensation" mine of the day *par excellence*.

The Caradon hill is skirted at its south base, as Captain Charles Thomas points out, by a border of what he calls "secondary" granite, which is replaced as we go north by what he calls the "primitive" granite—an unproductive rock. East Caradon has been working for many years northward without success; but a couple of years ago by a happy accident in driving south the rich Caunter lode was cut at the 50, containing a splendid lode of black copper ore—indeed probably one of the best deposits of that kind of ore ever met with in the county. Every person connected with metallic mining, and indeed most mining speculators, are aware that deposits of black copper are much more uncertain and essentially shallow than any other ore of that metal; but then being comparatively soft they can be rapidly opened out and quickly taken away, and consequently can be made to yield larger profits in a shorter time than would be possible in the case of yellow ore. A discovery of this kind evidently presented an admirable opportunity of creating a "sensation" mine of the very first water, and the opportunity has certainly been made the most of.

In speaking thus of East Caradon, it must be quite understood that we say nothing whatever against the merits of the mine, which has been a splendid discovery and one that should have been highly beneficial to the interest of Cornish mining. So far from being enemies to the mine or to the Caradon district, its real enemies are those who, in unduly exalting it, are preparing for the mine and the district a Nemesis like that which a similar course of proceeding has brought down on its neighbouring district of Tavistock. When we see a mine like East Caradon with a bunch of ore which although a magnificent one is essentially non-permanent, selling for a much greater price *than any single mine ever sold for before in Cornwall*, the matter passes the bounds of all reason. Tresavean mine in Gwennap—the only very deep copper-producing district in Cornwall—which made rich for more than 300 fathoms down, and paid nearly three times the yearly profits that East Caradon is giving, never reached within 50,000*l*. of the price which East Caradon recently attained.

It may be argued that the price of the mine like Tresavean, which was in the heyday of its prosperity about thirty years ago, affords no criterion as to the price of a mine at the present day, and to dispose of such a sophistry as this it may be well to seek a more modern comparison. It would be impossible to find one more com-

pletely answering our purpose, than the mine we describe in this month's number—West Seton. If East Caradon for a few more accounts should be able to continue the rate of dividend declared at the last meeting—which is very doubtful—its annual profits will be 24,576*l*. By a reference to the statistics of West Seton given at page 337, it will be seen that for the last 5 years its profits averaged 21,000*l*. a year; and that for the years ending April 1860 and 1861 they averaged 25,400*l*.—or 1,000*l*. a year more than the rate of dividend which East Caradon is at present temporarily paying. Yet the highest price that West Seton ever reached in the noonday of its greatest profits, was 168,000—while East Caradon recently sold for 337,220*l*., or about double. So far from there being any reason for this astounding discrepancy, the facts are all the other way. West Seton is situated in what is, beyond all comparison, the finest mining district in Cornwall—a district which has been worked for centuries, and in the oldest of whose mines, Dolcoath, we have prospects of permanency greater than in all the mines of East Cornwall put together. In this district experience shows us, that one deposit of copper is generally followed by a deeper one, and the whole succeeded by tin—the limits of which, as far as we can see, are only bounded by our mechanical means. West Seton also, although never a "market" or "sensation" mine, has always been one of the best held in Cornwall; and consequently from an absence of sellers, has ever maintained what has been considered very high prices: indeed subsequent experience has proved, that when the mine went to 168,000*l*. it went beyond its value.

In comparison with the Camborne and Illogan district, the eastern districts of Cornwall and Devon have no pretensions to permanency. They have made in the St. Austell district, in the Liskeard district, and in the Tavistock district splendid shallow bunches of ore; but no permanently profitable deep mine has yet been found, although extensive trials have been made, particularly in the St. Austell district, to endeavour to find something under the old rich bunches. In Devon Consols also—which consists of five distinct mines, any one of which is as rich and some richer than East Caradon—the bunches of ore have been everywhere unbottomed, and the most persevering trials have not yet succeeded in making any discoveries in depth. South Caradon is not a deeply productive mine, and everyone knows what the bottom of West Caradon is worth. Deprived thus of the prospects in depth, the permanent mines of the eastern districts owe their continuance to the great extent of their sett in a productive zone of ground—as is the case in Devon Consols and South Caradon. This resource is not possessed by East Caradon whose extent on the Caunter lode, which is down at the extreme south corner of their sett, is limited. Northward, where their sett is extensive, the "primitive" unproductive granite comes in—which, whether in the case of the Caradon hill, of the Carn Brea range, of Carn Marth, or of Carn Kie, has invariably failed to be profitably productive.

The extraordinary fatuity which should cause a mine so situated to sell for double the price of a mine like West Seton, paying greater profits, can only be accounted for by the boundless ignorance of mine

speculators, blinded and dazzled by "sensation" puffing. The only thing we can compare it to, would be buying Turkish Consolidés at 180 with Consols at 93.

We wish again to state that in making these obrervations we have not the least desire to disparage East Caradon or the Eastern mining districts. The former is a fine and valuable mine, although never worth more than half the price it reached in its character of the great "sensation" mine of the day. The Caradon district is a fine one, in the productive zone skirting the granite; and probably will still produce many mines, which, although having no pretensions to the permanency of the great mines of West Cornwall, may yet yield large and rapid, although, probably comparatively short-lived, profits. Dolcoath was a mine centuries old before Devon Consols was ever heard of, and judging from present prospects is not unlikely to see out not only Devon Consols, but half-a-dozen similar mines. In fact we can see our way into Dolcoath for a generation, which is certainly not the case in any eastern mine. But it does not follow from this that these eastern mines are not splendid successes: the only thing is to keep their prices within reasonable limits, and prevent the name of mining being disgraced by an unreasoning inflation which is necessarily followed by a proportionate collapse.

We had prepared a series of statistics to show more clearly and conclusively the enormous losses entailed by this system of "sensation" mines. Our space however obliges us on the present occasion to postpone these.

Abstracts and Reviews.

An Inquiry into the Deposition of Lead Ore in the Mineral Veins of Swaledale, Yorkshire. By Lonsdale Bradley, F.G.S. London: Edward Stanford Charing Cross.

For this most valuable, but unpretending, volume the mining community, and those interested in the study of metalliferous deposits, are much indebted to Mr. Bradley. It consists wholly of facts but slightly generalised; and avoids the serious danger of other recent publications respecting the lead formations of the North of being written to confirm any particular theory.

The work consists specially of ten chromo-lithographic plates giving fifty sections of the strata containing the lead veins of Swaledale, and showing forty throws varying from one to forty fathoms. The greater or less productiveness of the veins which coincides with these throws or faults, and which productiveness is directly influenced by the nature of the strata traversed by the vein, is shown in each case by different colours—which indicate the productive portions (with or without Rider), those productive in the presence of a Rider, the uncertain portions, the unproductive portions, and the unexplored portions. These plates are accompanied by letterpress returns from 192 distinct veins, more or less explored in Swaledale, over an area of about 200 square miles. Of these 170 are returned as *productive*, but 22 being found *unproductive*.

Swaledale—one of the most famous of the North Riding "Dales"—is bounded on the north, west, and south, by hills of Millstone Grit. Through these the valley has excavated its way through the whole of the Upper

Limestone series or Yoredale rocks of Professor Phillips, to the Lower Limestone which occupies the bottom of the valley from Muker to a considerable distance eastward. The mineral character of these Limestone series varies considerably; but they are essentially made up of four classes of rock: Limestone, Chert, Grit, and Plate, or Shale. Of these Mr. Bradley gives six original analyses, which is one of the most valuable practical features of his work. Among these rocks the Limestones, from which the series derives its name, are of course the most important, and it is to the uppermost of these that the most valuable deposits of galena are confined.

Whether the poverty of the veins in the Lower Limestone is due to their not having been sufficiently explored in those measures or otherwise, would be too wide a question to enter upon here; but it is worthy of remark that, according to Mr. Bradley's analyses, the higher Limestones of the series are by far the richest in carbonate of lime, there being a difference of 17 per cent. in this respect between the upper and lower beds.

Chert is a silico-calcareous deposit, dark in colour and extremely hard, though after exposure to the atmosphere it frequently assumes the appearance of white flint. In the analysis Mr. Bradley gives, carbonate of lime appears for 37½ per cent., and silicious matter for 58 per cent. Although the Chert deposits are generally thin they rank equal if not superior to the Limestones as producers of lead ore. Grit is essentially a silicious deposit, as sandstone or freestone, containing upwards of 90 per cent of silica with some mica and oxides of iron. In extent it is very important making up nearly one-half of the whole Limestone series; but as a lead-bearing rock it may be classed as unproductive save in a few exceptional cases, where it has produced large deposits of lead. The Plate or Shale is an essentially argillaceous deposit of laminated structure, containing much vegetable and carbonised matter as well as thin bands of ironstone. It is usually black in appearance, and is unproductive of lead ore.

Thus of the four rocks making up the Limestone series, two—the Grits and Plates may be classed as unproductive, and two—the Limestones and Cherts—as productive.

Besides the lead ore, most veins contain mineral matter between their walls, forming a gangue; and among the miners of the North Riding this is called the "Rider," and is the universal attendant of lead ore in strong and productive veins. Mr. Bradley classes the Riders of the Swaledale district under three heads: Fragmentary or Stony (*Primary*), Crystalline or Sparry (*Secondary*), and Sedimentary or Earthy (*Tertiary*), and the form of Rider seems to have an important influence on the productiveness of the vein. The Primary Rider is made up of broken portions of the beds, and is consequently contemporary with the vein; the Secondary Rider is crystalline; while the Tertiary Rider is merely the general filling up of the vein by recent sedimentary matter. As an instance of the connection between Riders and lead ore we may state that out of the 22 unproductive veins referred to, 19 were without Riders; while out of the 170 productive veins, 120 were productive with Riders. Out of the remaining 50 veins returned as productive without Riders, in 21 the ore made in flats, and not in the veins themselves; while in the remaining 29 the lead made in the main Limestone accompanied by red ferruginous Vamp. The general conclusions regarding veins arrived at by Mr. Bradley are as follows:—

1st. That veins of small throws are the most productive of lead-ore.

2nd. That veins of small throws have a general bearing of W. and S. W. to E. and N. E.

3rd. That veins of small throws are the most productive of lead-ore, from having ore-bearing or ore-producing beds on each side of the vein, opposite or nearly so to each other.

4th. That veins of small throws invariably carry a primary, a secondary, or a compound Rider.

5th. That veins of large throws are generally cross veins, and have a direction N. and S., or N. W. and S. E.

6th. That veins of large throws are invariably unproductive, because the ore-bearing beds are thrown past each other.

7th. That cross veins of large throws when productive of lead-ore are usually so in the Limestones accompanied with a tertiary Rider.

At the meeting of the British Association in 1858, a paper was read by the late Mr. Stephen Eddy on the Lead Mining Districts of Yorkshire, which he divides into two Fields—the Northern and Southern Fields;—the former including Arkendale, Swaledale, and Wensleydale, and the latter the mines of the Craven Country extending as far south as Cononley in Airedale. This, from Mr. Eddy's great practical experience, will be found a valuable paper for reference; and taken in connection with Mr. Bradley's book will serve as a guide to those desirous of making themselves acquainted with the great lead-mining districts of the North and West Ridings of Yorkshire.

THE BOARD OF TRADE RETURNS.

The "Accounts relating to Trade and Navigation of the United Kingdom, for the month ended 30th September, 1862, and nine months ended 30th September, 1862," have been issued by the Statistical Department, Board of Trade.

IMPORTS.—The imports of metals and metallic ores for the month and nine months ended 30th September, have been as follows:—

	Month ended 30th September.		Nine Months ended 30th September.	
	1861.	1862.	1861.	1862.
Brimstone .. .. cwts.	39,811	92,519	545,855	844,435
Copper Ore .. .. tons	9,405	6,473	58,153	63,885
Copper Regulus .. "	4,918	570	1[illegible],751	25,802
Copper, unwrought and part wrought .. cwts.	30,880	30,080	188,020	206,380
Iron, in Bars, unwrought tons	7,350	8,769	24,151	27,759
Steel, unwrought .. "	447	406	2,333	3,186
Lead, Pig and Sheet .. "	1,325	1,606	13,989	15,308
Spelter or Zinc .. .. "	1,390	2,525	15,523	12,516
Tin, in Blocks, Ingots, Bars, or Slabs .. cwts.	6,148	8,977	35,152	58,273
Silver Ore .. value in £	14,320	22,095	209,748	218,788
Quicksilver .. .. lbs.	414,109	306,884	1,703,620	432,138

Comparing the imports of these articles during 1861 and 1862, the only changes to be remarked are—an *increase* in unwrought copper of 800 cwts. during the month, and of 18,360 cwts. during the nine months; in unwrought iron, in bars, of 1,419 tons during the month, and 3,608 tons during the nine months; in tin in blocks, of 2,829 cwts. during the month, and 23,121 cwts. during the nine months; in silver ore, of 7,775*l.* worth during the month, and 9,040*l.* worth during the nine months; and a *decrease* in quicksilver of 107,225 lbs. during the month, and 1,271,482 lbs. during the nine months. Copper ore shows a decrease during the month, but an increase during the nine months; in spelter there is an increase during the month, but a decrease during the nine months.

EXPORTS.—The quantities and declared value of the exports of metals, minerals, and metallurgical articles of British and Irish produce and manufactures, for the month, and nine months ended 30th September, have been as follows—

		QUANTITIES.				DECLARED VALUE.			
		Month ended 30th September.		Nine Months ended 30th September.		Month ended 30th September.		Nine Months ended 30th September.	
		1861.	1862.	1861.	1862.	1861.	1862.	1861.	1862.
						£	£	£	£
Alkali: Soda	cwt.	121,310	227,304	999,302	1,610,935	53,117	98,890	436,614	682,249
Coal, Cinders, and Culm	tons	661,309	910,049	6,001,616	6,453,923	300,556	403,235	2,744,832	2,892,385
Iron, Pig and Puddled	"	30,147	46,318	292,819	353,151	83,281	127,996	786,613	948,356
Iron, bar, Angle, Bolt, and Rod	"	20,006	28,939	192,335	227,924	141,563	225,202	1,395,466	1,657,381
Railroad Iron, of all sorts	"	35,408	38,615	314,019	309,947	282,168	243,966	2,413,304	2,133,607
Iron Wire	"	761	1,244	9,248	9,392	13,348	26,056	161,989	205,463
Iron, Cast	"	7,467	5,895	53,993	48,196	63,155	54,044	499,920	419,738
Iron Hoops, Sheets, and Boiler Plates ..	"	6,511	11,027	61,931	76,862	66,956	105,270	631,505	759,451
Iron, wrought, of all sorts	"	10,633	14,380	79,590	96,236	183,154	247,202	1,496,218	1,590,125
Iron Steel, unwrought	"	1,674	2,010	15,971	20,105	53,560	62,844	524,196	650,504
Copper, unwrought in Ingots, Cakes or Slabs	cwt.	6,967	11,546	71,410	80,330	35,440	55,421	355,974	391,888
Copper, wrought, or partly wrought, Bars, Rods, Bottoms, Pans, Plates, Sheets, and Nails; and mixed or Yellow Metal for Sheathing ..	"	26,639	40,567	224,932	318,701	109,570	187,764	1,076,112	1,466,272
Copper, wrought, of other sorts	"	4,707	4,488	33,009	21,208	26,413	25,651	189,221	127,208
Brass of all sorts	"	2,837	4,488	21,343	28,355	15,247	22,803	119,561	155,729
Lead, Pig, Rolled, Sheet, Piping, Tubing, and Lead Shot	tons	2,249	2,727	14,194	26,069	47,184	58,079	314,594	552,300
Lead Ore, Lead, Red and White and Litharge of Lead	"	561	510	4,393	6,389	13,996	12,584	112,986	114,262
Tin, unwrought	cwt.	7,714	8,461	45,253	65,869	46,241	48,566	275,835	381,256
Tin Plates	"	—	86,962	—	816,580	58,688	105,523	655,275	981,964
Zinc or Spelter, wrought or unwrought ..	"	7,303	8,176	70,209	69,738	7,017	9,576	76,682	70,520
Salt	tons	50,952	62,953	554,904	514,735	26,489	29,136	297,191	247,987

Comparing the value of the exports of these articles during 1861 and 1862, we have the following results:—

FOR THE MONTH ENDED 30th SEPTEMBER.—During this period of the present year, the total value of exports has been 2,149,808*l.* against 1,627,143*l.* during the corresponding period of 1861, showing a *nett increase* of 522,645. On the separate articles enumerated, the respective increase and decrease has been as follows:—

Increase.—Alkali, 45,773*l.*; coal, cinders, and culm, 102,679*l.*; iron (pig and puddled), 44,715*l.*; iron (bars, &c.), 83,639; iron wire, 12,708*l.*; iron hoops, sheets, &c., 38,314*l.*; iron (wrought), of all sorts, 64,048; iron steel (unwrought), 9,284*l.*; copper (unwrought) 19,981*l.*; copper (wrought or partly wrought), bars, &c., 78,194*l.*; brass, 7,556*l.*; lead, 10,895; tin (unwrought), 2,325*l.*; tin plates, 46,835*l.*; zinc or spelter, 2,559*l.*; and salt, 2,647*l.* Making a total gross increase of 572,152*l.*

Decrease.—Railroad iron 39,202*l.*; iron (cast), 9,111*l.*; copper, (wrought), of other sorts, 762*l.*; and lead ore, 1,412*l.*; Showing a total gross decrease of 50,487*l.*

FOR THE NINE MONTHS ENDED 30TH SEPTEMBER.—During this period of the present year, the total value of exports has been 16,458,645*l.*, against 14,563,088*l.* during the corresponding period of 1861, showing a *nett increase* of 1,895,557*l.* On the separate articles enumerated, the respective increase and decrease has been as follows:—

Increase.—Alkali, 246,635*l.*; coal, cinders, and culm, 147,553*l.*; iron (pig and puddled), 161,743*l.*; iron, bars, &c., 261,915*l.*; iron wire, 43,474*l.*; hoops, sheets, &c., 127,946*l.*; iron, wrought, of all sorts, 93,907; iron steel (unwrought), 126,308*l.*; copper, (unwrought), 35,914*l.*; copper, (wrought, or partly wrought), bars, &c., 390,160*l.*; brass, 36,168; lead, 237,706*l.*; lead ore, 31,276*l.* tin (unwrought), 105,421*l.*; and tin plates, 326,689*l.* Showing a total gross increase of 2,372,815*l.*

Decrease.—Railroad iron, 279,697*l.*; iron (cast), 80,182*l.*; copper, (wrought), of other sorts, 62,013*l.*; zinc, or spelter, 6,162*l.*; and salt, 49,204*l.* Showing a total gross decrease of 477,258*l.*

Address to the Geological Section of the British Association, at Cambridge, October 2nd, 1862. By J. Beete Jukes, M.A., F.R.S., Local Director of the Geological Survey of Ireland, and Lecturer on Geology to the Museum of Irish Industry. President of the Section. (Printed for Private Circulation.)

We have more than once referred to Mr. Jukes as the most thoroughly practical writer among our leading geological authors—due to his great experience as a field geologist working for many years on the Survey. On the present occasion, however, we meet him on the area of theoretical geology; and here we find him, as a generaliser, not less successful than we have hitherto recognised him as an observer. His Address to the Geological Section of the British Association is as clear and forcible an exposition of what we may call—as distinguished from the doctrines which have been hitherto most generally popular—the New Philosophy of Geology.

This Philosophy of Geology, whose great expositor for the last five and twenty years has been Sir Charles Lyell, found, strange to say, comparatively little general favour until very recently in the Geological world; and its greatest advocates at present are those who—although not exactly young geologists—still have no claim to rank among the Nestors of that science. We have already stated that Mr. Jukes occupies an advanced position in the ranks of the holders of Lyellian doctrines; and in the present Address he takes another forward step as an advocate of the potency of existing causes.

The subject which he deals with on the present occasion is an enquiry into the causes which have determined the external features of the earth's surface—the mountains, hills, table-lands, cliffs, precipices, ravines, glens, valleys and plains. By the popular school of geology it has been always more or less held that these external features are connected in a greater or less degree with the action of those deep-seated agencies whose effect we see in the action of earthquakes and volcanoes. For a long time it was almost tacitly accepted that all elevated lands coincided with anticlinal axes, and all valleys with synclinal troughs. Mr. Jukes' purpose is to combat the general views of which these may be taken as an exaggerated type; he believes the present features of the earth to be due—not to the effects of these internal forces of disturbances, but to the effect of the external forces of atmospheric and marine denudation, acting, it is true, by processes infinitesimally slow, but carried on through periods of time indefinitely great.

In the case of plains he instanced that of the Fens and the great central plain of Ireland; the latter with an average elevation of less than 300 feet, having immediately beneath it abruptly undulating beds of Carboniferous limestone, rising up at all angles, and dipping in all directions—the most level points sometimes cutting horizontally across the most contorted and perpendicular beds, thus showing that the internal forces of disturbance had nothing at all to do with the production of the present surface, which had been formed across all these bent and broken beds after the disturbances had ceased.

Hills and mountains—excepting volcanoes or mountains of ejection—he divides into two classes according as they (1) are caused by the removal of the rocks which once surrounded them, or (2) have suffered from the removal of those once spread over them. The first have simply been *left high*, while the surrounding ground has been worn down. The second have indeed been thrust up into once superincumbent beds; these having been removed, the hills remain, not in consequence but in spite of denudation. The first class he calls "*hills of circumdenudation*" and the second "*hills of uplifting*." Even among the latter class, to which belong all the great mountain chains of the world, the internal forces operated simply by lifting up the rocks to within the region of denuding influence; they only produced the indirect effect of bringing to different levels, and placing in various positions, masses of rock of various hardness and constitution, on which the external forces might take effect to mould them to their present form.

The general conclusion therefore arrived at is, that the surfaces of our present lands have been as it were carved and sculptured by external forces, the result of whose action has altogether depended on the "weatherable" nature of the rock; the hard siliceous rocks being best adapted to resist the chemical and mechanical action of water, forming the prominences, while the softer and more soluble rocks have been scooped into valleys or levelled down into vast plains. None of the present features of the surface of the globe have been produced by the direct action of internal forces, except volcanic orifices and cones; all others have been produced by the process of external erosion.

Among the erosive agents the Ocean has been the grandest—its action being like that of a great horizontal planing machine. Rain, acting both chemically and mechanically, comes next; and after this the Atmosphere, with its moisture and gases. Running water, from the rivulet to the greatest river, has also been among the most active of eroding agents; and lastly, after Professor Ramsay's paper in the last *Geological Journal* (noticed in our October number) we must not omit the action of flowing glaciers, to which the Professor attributes the formation of the "rock basins" in which lie the lakes of Switzerland. To these, acting slowly, but simultaneously, in different parts of the world, through countless ages, are

to be attributed, in Mr. Jukes's opinion, the present conformation of the earth's surface. Small causes acting through periods of time indefinitely great—

> "The sound of streams that swift or slow
> Draw down Æonian hills, and sow
> The dust of continents to be."*

Such is the most recent phase of Lyellian philosophy applied to the external features of the earth's surface.

It must be a matter of sincere congratulation to all well-wishers to Geology to find, as directors of the Survey men like Mr. Jukes who can take a comprehensive grasp of the science as well as elucidate its minutest details. *A priori* speculations on physical science or generalisations on insufficient data are about the most unsatisfactory forms to which mental energy can well be applied; but next to these we may safely class energies employed in the mere accumulation of disjointed and disconnected facts. As a natural reaction from a period characterised by the former weakness—in which professed geologists carried on their controversies with as much bitterness, and as little reference to facts, as if the subject were theology instead of geology—scientific societies discouraged for a lengthened period anything like generalisation. It was a reproach to them that they confined their labours to the registration and discussion of facts—often of the very least importance—which were considered and dealt with as isolated and disconnected. Now however this is changed, and those who collect fossils or minerals in the spirit of an old lady collecting crockery are fast disappearing. A dread of being charged with "theorising" no longer deters men of ability—men who are capable of grasping a dozen facts at a time—from generalising from time to time our stock of accumulated facts, without which there can be no real scientific progress. Of course generalisations are most satisfactory and reliable when—instead of mere amateurs—they proceed from men who from their official position necessarily possess the largest knowledge of details. Men such as Mr. Jukes, Professor Ramsay, and Professor Huxley.

Compared even with the long established—in many instances almost historical-scientific engineer *corps* of Continental states we have every reason to be proud of the officers of our own Geological Survey. Considering the influences under which Government appointments are too frequently made, the inevitable system of irritating red-tapism into which they almost uniformly degenerate—and in this respect the more recently established seem to be the worst—we cannot be too thankful to the late Sir Henry de la Bêche for the happy selection he made in founding the nucleus for the Jermyn Street establishment. In Dr. Percy, Mr. Warington Smyth, Professor Ramsay, Mr. Jukes, and many others, we may safely say that we possess men not to be exceeded in their respective spheres by any *corps* in Europe; and among the younger members of the Survey we think the comparison may equally hold good. The Geological Survey and the Royal School of Mines are not unworthy of their eminent Director-General Sir Roderick Murchison.

ASSOCIATION FOR THE PREVENTION OF STEAM-BOILER EXPLOSIONS, MANCHESTER.

At the last ordinary monthly meeting of the Executive Committee of

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* *In Memoriam.* Nothing is more noteworthy in our great contemporary poet than the extensive and perfectly sound knowledge of geology displayed in his works. In an article in the *Saturday Review* some time ago much of this was shown; but some of the profoundest and finest points—which occur in *In Memoriam*—were passed over.

this Association, held on Tuesday, October 28th, William Fairbairn, Esq., C.E., F.R.S., in the chair, the chief engineer presented his monthly report, of which the following is an abstract:—

During the past month there have been examined 353 engines and 539 boilers. Of the latter 9 have been examined specially, 9 internally, 48 thoroughly, 473 externally, in which the following defects have been found:—Fracture, 7 (1 dangerous); corrosion 30 (3 dangerous); safety-valves out of order, 15; water gauges ditto, 7; pressure gauges ditto, 20; feed apparatus ditto, 7; blow-off cocks ditto, 27; furnaces out of shape ditto 3; blistered plates, 5. Total, 121 (4 dangerous). Boilers without glass water gauges, 8; without pressure gauges, 7; without blow-off cocks, 18; without back pressure valves, 50.

Three explosions have occurred during the past month to boilers not under the inspection of the Association, these boilers were in the iron districts, and of the externally-fired hay-stack class; they were reported as having been of original defective construction, being insufficiently stayed.

Incrustation and Scum-Pipes.—The number of boilers under inspection which suffer from incrustation is very large; indeed, to escape this inconvenience is quite exceptional. It forms an impediment to inspection, since it renders it difficult to ascertain the actual condition of the plates; it sometimes gives a delusive appearance, and leads to undue suspicion of corrosion, but more frequently it conceals defects, since corrosion is often found to be going on under, and to be caused by, the deposit.

In addition to the waste of fuel occasioned by incrustation, the wear and tear of boilers is considerably increased, apart from the effects of overheating. Thus internally double-flued boilers suffer from the undue longitudinal expansion given to the furnace crowns, which increase the tendency to groove at the front end plate, an action always more or less developed in these boilers, while incrustation renders the use of tubular boilers altogether impracticable in localities not supplied with good water, and thus prevents the more general use of this economical class of boiler.

Although the danger of allowing incrustation is too fully appreciated to need remark, the fact is not so fully recognised that even where no actual cake of deposit is formed, over-heating frequently occurs. It is thought that this may be due to the presence of thickening matter in the water, and it would be interesting to ascertain whether the impediment thus presented to the free escape of the steam does not lift the water off the plates, and thus cause overheating. Of the fact of overheating occurring where no incrustation is formed, and with an ample supply of water in the boiler at the time, there is no doubt, chiefly in boilers externally fired.

Apart from the injury done to the boilers from incrustation, a considerable amount of earthy matter passes over with the steam into the engines, and thus renders necessary the use of an increased amount of tallow for the piston and slides. This, though too frequently lost sight of is illustrated by the fact that where boilers are fed from brooks, subject on heavy rains to sudden torrents which stir up the mud, the engine attendants are in the habit, at such times, of taking the precaution of giving the engine cylinders an extra amount of lubrication, finding the pistons, &c., to clog when this is neglected.

Under ordinary circumstances the most practical plan for the prevention of incrustation is the adoption of an efficient mode of "blowing-out," and not the use of "boiler compositions." To blow out, however, from one point only, at the bottom of the boiler, which is the general custom, has but a very limited and local effect. This is frequently remedied by the adoption of a perforated pipe, which is connected to the ordinary blow-out tap, and carried along the bottom of the boiler from one end to the other. These are technically termed "Topham-pipes," from the name of the patentee, and are generally spoken highly of by those who have adopted them. They

are, however, more successful where the sediment being heavy and sludgy falls to the bottom, than where it is of a lighter character, which frequently forms the hardest and most tenacious scale.

From the rapid ebullition that takes place within boilers when under steam, it is found that the greater part if not the whole of the sediment set free by evaporation rises to the top of the water, forming a coat of scum before finally depositing itself, and thus the readiest way of preventing incrustation is to blow out this layer of scum from the surface of the water by means of a scum pipe before it has an opportunity of settling. There is nothing new or experimental in this; the system has been for years adopted with marine boilers, and there is no reason why its use should not become equally general with stationary ones. Many have already tried it with considerable success, and find on opening their boilers after a month or six weeks' work, that where they used formerly to be coated with a heavy muddy deposit they are now perfectly clean.

The following is an explanation of the description of pipe adopted:—It is about three or four inches in diameter, having a wing cast to it on each side, so as to form a trough throughout the entire length of the pipe. This pipe is carried within the boiler, from one end to the other, being made in any convenient lengths for introduction at the manhole: it is perforated with small holes on the top all the way along, the aggregate area of the whole number of these holes being equal to that of the pipe itself. The top of the trough is fixed a few inches below the level of the water, so that the scum on the surface may flow over it, when, being guarded by the disturbance of the ebullition, it deposits in the still water above the trough the sedimentary particles held by it in mechanical combination. A tap is fixed to the front end plate of the boiler in communication with this pipe, by means of which it can be blown out as frequently as is desired, which should not be less than once every two hours when ebullition is going on. This tap, which need not be more than two inches in diameter, should be entirely of brass, fitted with a gland, and have a neat waste-pipe attached, which may be of wrought iron, while also the waste-pipes from the glass water-gauges may be connected to it, being led immediately under the dead-plate, which arrangement is found to be very compact and convenient. The best position for the scum-pipe is at the side, and not at the centre of the boiler, both on account of facility of fixing, and convenience of getting inside. A single pipe is sufficient.

The above description is not by any means given as if that were the only form of scum-pipe that could be advantageously applied. It was designed as being adapted to stationary boilers, simple in construction, affording a large collection area, and being free from any patent right. Upwards of a year's trial has proved it to be successful, and its more general adoption is consequently recommended. These pipes have already been made by the manufacturing engineers of Rochdale, Bolton, Bury, and other places, but are needed more generally.

There are other plans in operation which, however, are subject to patent right. One of these consists of a series of vertical pipes, fixed in the centre of the boiler, each pipe having a trumpet mouth to which a vertical telescope movement is given to allow for the changes of water-level, the movement being effected by a copper ball float, so that the trumpet mouth rises and falls on the changes of water-level, like a buoy on the rise and fall of the tide; the object being to keep the mouth of the pipe immediately below the surface of the water, in close proximity to the scum. A second plan consists of a trumpet mouth laid horizontally. Both of these arrangements are reported to give satisfaction.

Some descriptions of incrustation, however, cannot be entirely removed by any blowing-out apparatus alone, however perfect; in such cases a little carbonate of soda may be added with considerable success. While with

regard to complicated "boiler compositions" generally, it is found that they are expensive, in many cases useless, and in others injurious. The use of soda without a scum-pipe is found in some cases to induce priming, the soda combining with the grease within the boiler, and producing foaming of the water.

The general adoption of scum-pipes is therefore confidently recommended to the members, not only for the prevention of incrustation, but also in order to lengthen the lives of their boilers, as well as to assist the engines in many cases by preventing priming.

The most radical cure for the prevention of incrustation, though one involving considerably more outlay at the first than the above, will be found in the adoption of dry or "surface condensation," by means of which the boiler is fed with distilled water, the same being used again and again with the exception of the slight amount lost through leakage.

ON BITUMINOUS SCHISTS* AND THEIR RELATION TO COAL.

By Professor D. T. ANSTED, M.A., F.R.S.

(Read before the Geological Section of the British Association.)

Rocks in which naphtha, petroleum, rock-oil, bitumen, asphalte, and other mineral hydro-carbons are present in sufficient abundance to characterise the deposit or attract attention, are widely distributed in various geological formations, and belong to no special geological period. Crystalline and metamorphic rocks contain chappapote, and other forms of bitumen: rock oil rises in jets from below Silurian, Devonian, and Carboniferous rocks in North America; bituminous limestones and schists occur in Ireland in Silurian rocks, and at Caithness in Devonian rocks, and elsewhere, not unfrequently in the British islands, in Carboniferous rocks; bituminous schists are important in the Permian series in Germany, and not absent in the new redstone; the koridonia schists of the Lias and other beds are highly bituminous, and in the Oölites, the Cretaceous rocks, and even in the tertiaries, especially in Germany, the same bituminous character often prevails. Asphalte is common in some tertiaries; oil rises from the nummulitic rocks in the East, and in the West Indies we have the Pitch Lake of Trinidad.

In almost all these cases there is a marked distinction between coal, properly so called, and rocks containing the hydro-carbons. Coal is mineral fuel from which gas can be obtained by destructive, and occasionally certain oils by slow distillation. The various bituminous rocks or bitumens contained in rocks are not good fuel, but yield largely certain valuable products by slow distillation. Coal can be coked, and the coke or unburnt carbon is a valuable fuel. The best and richest of the bituminous schists will not coke, and the result of an attempt to make it is to produce an ash that will not burn.

Notwithstanding this general distinction, coal passes insensibly into cannel coal, or parrot, and this again into those peculiar shales rich in bitumen, known in Scotland as Boghead coal, or Torbane Hill mineral. These remain debateable ground. They can be used as fuel, though very imperfectly; parts of one mass will be like coal, and other parts like shale. They are unusually rich in valuable oils, and form a curious passage between two minerals, coal and shale or schist, that do not generally bear any resemblance.

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* This term, *bituminous schists*, is not altogether correct, as the minerals so called do not contain bitumen properly so called. It is however in familiar use, and to be preferred to the term *pyro-schist* suggested by Dr. Sterry Hunt, which is equally incorrect, without having the advantage of being familiar.

The distinction between coal and shale is practically very important, and deserves careful consideration. I am anxious to direct the attention of the Section to some instances that may help to throw light upon the question.

Two localities in France visited by me in the year 1861, are particularly interesting in this respect, and deserve to be better known by English geologists than they seem to be. These are both of the Carboniferous period. The various places where the Lias schists are now worked for distillation, chiefly in Germany, are also worthy of special reference, and the tertiary bituminous shales of the Rhine are not less important.

At Feymoreau, a short distance from Fontenay le Comte, situated in the Bourbon Vendée between Nantes and Rochelle, there is a small coal-field almost classical in respect to the important distillation of light oils by slow distillation of rocks containing hydro-carbons. It was at this spot, then far less accessible than it now is, that M. Selligué so long ago as in 1830 obtained light paraffine oil, heavier illuminating oil, lubricating oil, and paraffine, by a method identical with that patented by Mr. Young in 1851. The works were abandoned owing to the want of communication with a market, and M. Selligué afterwards established works still carried on successfully at Autun.

The Feymoreau schists underlie coal of a poor quality—thus replacing underclay; but they contain no vegetable impressions or markings. They are of deep black colour, hard and tough when first exposed, but fall to pieces after a time. They burn freely with much smoke and a very long flame, but cannot be used as fuel. Externally they very much resemble the better qualities of Boghead and Torbane mineral, but they yield only about 15 per cent. of light oil on a slow distillation. They contain 60 per cent. of ash and some water. The schists and coal both vary in thickness, and occasionally seem to pass into each other. The schists are in some places 30 to 40 feet thick, but they do not extend far in any direction, or at least if they extend under the coal, which seems probable, they are not everywhere bituminous.

The Feymoreau schists agree with the rich hydro-carbon minerals of Torbane Hill and Boghead in Scotland in appearance, geological position, and in the fact that they occasionally alternate with coal. They differ in being far less rich in useful products, and therefore always and readily distinguishable as schists, and not coal.

On the other side of France is Autun, where there is also a small coal-field, but where bituminous schists of precisely the same nature as those at Feymoreau generally occur in a part of the carboniferous series considerably above the highest coal seam, and several hundred yards above any workable bed. Below the coal at Autun are coarse grits of granite and gneiss alternating with black shales.

The bituminous shales are partly quarried, and partly obtained by drifts or headings reaching the more valuable beds. There are about ten feet of bituminous schist at Cordessa, where I visited the operations of mining and manufacture, and of these five only are valuable. Elsewhere the thickness is greater; the broken schist is black, but at the surface, while in the bed it is reddish-brown. The percentage of bitumen is very variable, sometimes amounting to 50 per cent. of oils of all kinds, but the average not much exceeding six at Cordessa, though much higher at Igornay, a place in the neighbourhood, where there are also works. At Chamtoy the rich shales are nearer the coal and alternate with it. A grey limestone and a clay ironstone occur in some parts of the Autun coal-field.

The Autun mineral oils are moderately rich in paraffine. The shales will not serve as a fuel, and are never so employed. Some beds are rather pyritous, and others abound with vegetable impressions, differing in this

respect from the Feymoreau schist. The general resemblance of the Autun specimen to Boghead is very striking.

The manufacture of schist oils and paraffine candles is carried on extensively in more than one place near Autun, and the quantity supplied is large. The methods adopted are the same as those of Mr. Young in general principle, and are said to have been little altered for twenty years.

The tertiary shales below the brown coal on the Rhine are found in many places to be very bituminous. They have no resemblance to coal or brown coal, and are easily distinguished from the latter. They are thin, and form the *blätte*, or *paper-coal*, of the Germans. They are worked near Linz and elsewhere, and are distilled at Beul, opposite Bonn, the products being precisely similar to those obtained from the other bituminous schists, and in nearly the same proportion, but the yield is small.

The peridonia schists of the Upper Lias are worked at present for economic purposes at Bamberg, in the north of Bavaria, and at Reutlingen, near Tübingen in Würtemberg. The manufacture of light paraffine oil, heavy oils for burning, lubricating oil, and paraffine, has been carried on with some success by the distillation of these schists, for some years. Recently a similar establishment has commenced work with the schists of similar age at Orawicza, in Hungary, near the Danube, at Baziasch.

The Eisleben Shales, amongst which the copper slate is deposited, are not less remarkable for their bitumen. This is apparently very intimately connected with the schists well known to geologists for the abundance of fossil fish found in them. In this case, therefore, there seems great probability of the bitumen being of animal origin. No difference has been observed as to the contents obtained on distillation.

The Kimmeridge coal has occasionally been used for paraffine, but being much less rich than the Scotch shales, the result is not sufficiently encouraging to justify a continuance of the experiment.

It is possible that some of the other black shales known in varions deposits may be found available, and may come into use for distillation.

It is evident that bituminous schists of various dates, some associated with and resembling coal, some even passing into coal, others totally unlike coal in every respect, and far removed from it geologically, exist in various countries in considerable abundance, and admit of profitable distillation at low heat for the purpose of manufacturing illuminating and lubricating oils and paraffine. It is important that such substances should be recognised as a class and not mixed up with coal, and that there should be some understanding as to what coal is, and in what it differs from the carbonaceous and bituminous minerals with which it is often loaded.

I append a list of a few of the rocks and localities where bituminous schists and their products are obtained. It would certainly admit of great expansion.

Lower Silurian.	Ireland and America (Attica, States.)
Upper Silurian.	Ditto.
Devonian:	Caithness schists. Shale, with 30 per cent of organic matter, and a residue of 8 per cent. of carbon. American rock oils.
Carboniferous: Lower, Middle, and Upper.	American rock-oils. Torbane Hill and Boghead, &c., minerals. Parrots, and cannel coal ? *Terre houille*, of Belgium. Vauvont or Feymoreau schists la Vendée.
Above Coal.	Autun schists.

Permian:	Eisleben shales, and kupfer schiefer, 5-20 per cent. of light oils. Mansfeld schists.
Lias:	Poridonia schists, worked in Northern Bavaria, at Bauz, in Wurtemberg, near Tübingen, at Dravicza, in Hungary.
Oölites:	Kimmeridge coal, (Dorsetshire), used for distillation to obtain paraffine, and as a very poor fuel.
Cretaceous:	Various schists in the Alps.
Tertiary:	Paper-coal, near Bonn, (under the brown coal.) Deposits beneath nummulitic rock in the East.

I have no doubt that a little research would remind us of many other localities, but these are enough to show that the presence of a certain quantity of hydro-carbons, the result, there can be no doubt, of organic matter exhibited in this form, a part of which has sometimes been converted into coal, but which is more usually quite distinct from coal, and quite unconnected with it.

I have not alluded in this paper to the surface accumulations of petroleum, or to the asphalte, with sand and in sandstone, nor to the chappote of Cuba—a very remarkable deposit deserving distinct notice. I have confined my remarks to the bituminous schists to bring the subject within compass.

THE NEW METAL *THALLIUM.*

By William Crookes, F.C.S.

(Abstracted from the Proceedings of the Royal Society.)

I have found the following the most advantageous method for extracting the new element from sulphur or pyrites:—

Powder the ore very finely, and dissolve it as completely as possible in strong hydrochloric acid, with gradual addition of nitric acid until all solvent action ceases; then dilute with water, and filter. Evaporate down to drive off the excess of nitric acid, add a little sulphuric acid if necessary, and take care that the solution does not get dry, or even pasty. Then dilute with water, and heat gently, to be certain of getting all the soluble portion dissolved. Filter: if lead be present, the greater portion will be left behind in this operation in the form of insoluble sulphate. Dilute the filtrate considerably, and add a solution of carbonate of soda until the reaction is distinctly alkaline; then add an excess of solution of cyanide of potassium (free from sulphide of potassium). Heat gently for some time, and then filter. The precipitate contains the whole of the lead and bismuth which may be present as carbonates, whilst the thallium is in solution. A current of sulphuretted hydrogen now being passed through the liquid, precipitates all the thallium, whilst the copper, antimony, tin, and arsenic remain dissolved. If cadmium and mercury are present, they will accompany the thallium. The former can readily be dissolved out by warm dilute sulphuric acid, which has scarcely any solvent action on the sulphide of thallium, whilst this in its turn can be separated from the sulphide of mercury by being boiled in moderately dilute nitric acid, in which the sulphide of mercury is insoluble. These two metals are, however, seldom present with thallium in the ores which I have examined.

The nitric acid solution is now to be evaporated to dryness, the residue dissolved in hot dilute sulphuric acid, and a piece of pure metallic zinc placed in the liquid; the thallium will be at once precipitated in the form of a deep brown powder, which soon changes to a heavy black, granular precipitate. The metal can be obtained in the coherent form by fusion in hydrogen.

This method of analysis is given on the supposition that all the above metals are present. It may generally be much abridged, as the ore is seldom of so complicated a character. If there is a difficulty in procuring perfectly pure zinc for the reduction of the sulphate to the metallic state, this can be effected by passing a weak voltaic current through the liquid, using platinum poles; the metal will then be precipitated in the reguline, or spongy state, according to the strength of the current. I have not been very successful in reducing the oxide by hydrogen. The current of gas carries the volatile oxide away from the heated part of the tube before complete reduction takes place. It is, however, probable, from an observation made towards the conclusion of this experiment, that, with a longer tube in proportion to the quantity of material, kept at a good heat throughout its length, this plan might give good results, the metal being considerably less volatile than the oxide.

In many cases, when minute traces only of thallium accompany large quantities of other metals, it may be advisable to repeat the whole or some of the above operations, in order to purify this element from foreign metals which may have escaped complete removal.

I now pass on to a description of thallium and its chemical reactions.

Thallium in the pure state is a heavy metal, bearing a remarkable resemblance to lead in its physical properties. Its specific gravity is, however, higher—about 12. The freshly scraped surface has a brilliant metallic lustre not quite so blue in colour as lead, and it tarnishes more rapidly than this latter metal. It is very soft, being readily cut with a knife and indented with the nail; it may also be hammered out and drawn into wire, but has not much tenacity in this form. It easily marks paper. The fusing-point is below redness, and with care several pieces may be melted together and cast into one lump. There is, however, generally a loss in this operation, owing to its rapid oxidation. The metal itself does not appear to sensibly volatile below a red heat. I have made no special attempts at present to determine the atomic weight, although from two estimations of the amount of sulphur in the sulphide it appears to be very heavy. The figures obtained did not, however, agree well enough to enable me to speak more definitely on this point, than that I believe it to be above 100. I may mention that I obtained this element in the pure metallic state and exhibited it several friends as early as January last,* and should then have published an account of it, had it not been for the reasons already mentioned. Thallium is soluble in nitric, hydrochloric, and sulphuric acids, the former attacking it with greatest energy, with evolution of red vapours.

Oxides of Thallium.—Thallium forms two, and probably three oxides: one possessing basic properties, which I shall call the oxide; another containing more oxygen, possessing acid properties, which may therefore be called thallic acid; and most likely a third, or suboxide, which forms the first portions of the precipitate formed by zinc in solutions of this metal; the first action being a darkening of the solution, and the production of a deep-brown powder, which by longer contact with zinc turns to a dense black precipitate.

Upon carefully evaporating the nitric-acid solution upon a waterbath but not carrying it to dryness, a mass of deliquescent crystals is obtained on cooling, which are decomposed upon addition of water with separation

* Vide Chemical News, Vol. V, pp. 349, 350.

of a white or pale-yellow precipitate, which appears to be a subnitrate, and an acid solution containing nitrate of thallium. If the liquid is evaporated quite to dryness and kept at a temperature of 100° C. for a little time, the nitric acid goes off, and leaves a residue of thallic acid.

Thallic Acid.—This acid is soluble in water, and may be obtained in the crystalline form from its aqueous solution. It then forms crystals, which are permanent in the air, and have an acid reaction to test paper. The thallates of the alkalies are also soluble in water, and may be prepared by dissolving the acid in the alkali, or by fusing thalium or its oxide with a mixture of alkaline carbonate and nitrate. The method I originally published for extracting thallium was based upon the formation in this manuer of an alkaline thallate soluble in water. This acid is also produced in solution when permanganate of potash is added to a soluble salt of oxide of thallium.

Chloride of Thallium.—If a current of dry chloride is passed over precipitated thallium at a moderate heat, they combine with formation of a volatile chloride, which condenses in the cool part of the tube in the form of a pale-yellow crystalline powder, fusing together in parts to a crystalline lump. Water only partially dissolves this, with production of a white insoluble residue. Dilute hydrochloric acid added to the turbid solution immediately renders it clear; upon evaporating this solution over a water-bath, white crystals of the chloride are deposited. When the nitric-acid solution of thallium or its sulphide is evaporated with an excess of hydrochloric acid, and then more hydrochloric acid added and the evaporation repeated to a syrup, a residue is obtained which is apparently decomposed by water with production of a white precipitate: this is chloride of thallium; it is insoluble or nearly so in water, but readily soluble in dilute hydrochloric or nitric acid.

Sulphide of Thallium.—When sulphuretted hydrogen is passed through the acid solution of chloride of thallium, a partial precipitation of a reddish-brown powder takes place; this appears to be a combination of the chloride and sulphide, and the metal is never entirely removed from solution by this means. The best method of obtaining the sulphide is to precipitate it with sulphide of ammonium in an alkaline solution: unless a large quantity of thallium is present, no immediate effect is produced beyond the darkening of the liquid; it assumes a brown tint, which becomes rapidly more and more intense, especially upon gently heating it, until the sulphide of thallium separates in the form of a deep-brown heavy precipitate which shows a great tendency to collect together in clots at the bottom of the vessel: this formation of the sulphide is very characteristic of the metal. Sulphide of thallium is insoluble in an excess of sulphide of ammonium, ammonia, or cyanide of potassium. Its complete precipitation as sulphide from solutions containing an excess of cyanide of potassium affords a ready means of separating thallium from several metals with which it is frequently associated. It is difficultly soluble in hydrochloric or sulphuric acids, but readily so in nitric acid. When dry, it is a deep-brown, almost black powder, fusing and volatilizing when heated: when pure, it is neither so fusible nor so volatile as sulphur; but when it occurs with an excess of this latter element, it is very difficult to separate from it by sublimation.

Carbonate of Thallium is precipitated upon adding an alkaline carbonate to the acid chloride solution; it is moderately soluble in an excess of carbonate of ammonia and readily so in cyanide of potassium. This is a very definite reaction, and enables thallium to be separated with accuracy from lead and bismuth.

Sulphate of Thallium.—When the hydrochloric or nitric solution is evaporated down with sulphuric acid, the more volatile acid is driven off and the sulphate is left behind. It is crystalline and soluble in water.

Iodide of Thallium is precipitated as a yellowish-red powder upon cautious addition of iodide of potassium to a solution of thallium. It is readily soluble in excess of iodide of potassium, forming a colourless solution.

Phosphate of Thallium forms a white flocculent precipitate soluble in mineral acids, but sparingly soluble in acetic acid.

Ferrocyanide of Thallium is white and insoluble in water.

Cyanide of Thallium is precipitated as a white or light-brown powder upon the cautious addition of cyanide of potassium to a solution of thallium. It is readily soluble in an excess of the precipitant.

Chromate of Thallium is a pale-yellow precipitate soluble in acids and reprecipitated upon neutralization with ammonia.

No precipitates are produced when a solution of thallium is mixed with *protochloride of tin, oxalic acid, carbazotic acid, sulphurous acid*, or *protosulphate of iron*.

(To be continued).

Correspondence.

HEATING OF LEAD CRYSTALLIZING POTS.

Sir,—Permit me to draw the attention of metallurgists to the present plan for heating the pots for Crystallizing Lead, and to point out an idea that has occurred to me, which I am inclined to think, if properly carried out, would be found a great improvement.

The process of Crystallizing Lead is performed in a series of hemispherical metal pots, each set over a separate fireplace, from which there is a flue for the escape of the smoke that descends into a main flue common to all the pots leading to the bottom of a perpendicular chimney.

The fuel is first lighted under one pot, and after the lead to be operated upon has been melted in this, it is removed to the next pot in the series; so that for each set of men one fire at a time is all that is wanted, excepting the fire for the tempering-pot between the two large pots. The fire is thus removed from pot to pot as the work proceeds; but should the pot in which the crystals are being formed be likely to cool too quickly, there is often a damper in its flue which may be closed so as to prevent the heat from passing off too rapidly.

This frequent removal of the fire is a very hot and disagreeable job for the men, and in the course of working the several pots gives rise to a great loss of heat, and of heat-producing matter; because each time that the fire is made up a quantity of carbonaceous matter passes off unconsumed, while a film of it is deposited on the upper part of the pot, particularly in the case of a double-flanged pot, unless a clear fire is instantly produced, which with the greatest skill and care is difficult to accomplish. This film of carbonaceous matter being a bad conductor, so long as it remains a great portion of the heat passes off and its effects are lost. In speaking of these present arrangements, I may point to the prevailing though preposterous plan of setting the pots with descending flues, which involves an extra expenditure of fuel, when by a very simple plan an ascending flue might be had, by which, besides, the inconvenience from heat underneath the workmen's feet would be avoided.

With this explanation of the present state of things, I may mention

what has occurred to me. In reading a notice of M. Siemen's heat regenerating gas furnace, I see that Professor Faraday shows the invention to be applicable in glass-enamelling, tube welding, iron-puddling furnaces, &c., with the advantage of using "slack" instead of ordinary coal; while it is easily managed, affording any desired temperature, and effects a saving of one-half in fuel. If the invention can be so advantageously used in the above process, may it not be equally applicable to and effect a similar saving in fuel in heating Crystallizing Pots?

October 24th, 1862. A SUBSCRIBER.

NOTICES TO CORRESPONDENTS.

SUBSCRIBER, MERTHYR.—The Memoir of Messrs. Gruner and Lan is still in course of publication in the *Annales des Mines*. When concluded it will no doubt be published in a separate form, of which you will see a notice in the *Magazine*. If you have the knowledge of French you state we should recommend you to try the original, for perseverance will soon enable you to understand the technical words: if there be any you cannot make out, we shall be happy to give the meaning if you send a list. We strongly advise you to wait for Dr. Percy's volume on iron, which is certain to be infinitely superior to anything at present published, as well as very much cheaper than the work you mention. You should get the Iron Ores of Great Britain, published by the Geological Survey. You may be sure there is still an immense field for the application of sound chemical knowledge to the metallurgy of iron.

Notes and Memoranda.

MINERS' ASSOCIATION OF CORNWALL AND DEVON.—Mr. Robert Hunt, F.R.S., has been giving lectures in various parts of Cornwall for the benefit of this Association. At Redruth On Coal and its Products, and at Helston On the Study of Rocks.

UTILISING THE HEAT OF COKE OVENS.—Among new inventions may be mentioned one which relates to the utilising the spare heat of coke ovens, for the purpose of heating air for blast-furnaces, calcining ironstone and other materials, and for heating and smelting iron. The invention has been provisionally specified by Mr. J. Harding, of Beeston Manor Iron and Coal Works, Leeds. He causes the mouths of a group of coke ovens to open into a flue, which leads [directly into the chamber in which the heat is to be employed.

BORING MACHINES.—An invention has been patented by Messrs. Harrison of Pimlico and Henry John Stanley of Westminster, for "An improved instrument or tool for boring and drilling holes in slate or other rock." The improvement consists in supplying a continuous stream of water to the cutter at its point of contact with the rock, which not only prevents the cutter from being injuriously heated, but at the same time washes away and forces back the borings as soon as they are disengaged from the rock, rendering clogging impossible. In the September number of this Magazine we gave a description of the boring machine in use for tunneling under Mount Cenis which seems to be on much the same principle.

GEOLOGICAL SOCIETY OF LONDON.—At the meeting of this Society on Wednesday, November 5th, Professor A. C. Ramsay, President, in the Chair. The following communications were read:—

1. "Descriptions of some Fossils from India, discovered by Dr. Fleming of Edinburgh." By Dr. L. G. Konninck, For. Mem. G. S.

2. "On a deposit containing *Diatomaceæ*, Leaves, &c., in the Iron-ore Mines near Ulverstone." By Miss E. Hodgson, communicated by the President.

The object of this paper was to show that this deposit, which was first described by Mr. Bolton in the Society's Journal, vol. xviii. p. 274, and considered by him to be of Lacustrine origin, was deposited in a large cavern or chain of caverns by a subterranean stream, originating probably in a brook called the 'Poaka Beck.' The authoress first described in detail some of the various caverns and swallow-holes which abound in the limestone of the district; and then alluded to the current belief of their communication with each other, and with springs. Miss Hodgson also remarked that, prior to the year 1842, the Poaka Beck, after having become partially engulphed at Inman Gill, is said to have taken a subterranean course. Since the above-named date, its course has been diverted. Mr. Bolton's sections were then critically examined; and the paper concluded with a list of the *Diatomaceæ* found in the deposit, with notes on the places where they occur in the streams of the district, and with some remarks on the vegetable remains.

3. "On the Geology of a part of the Masulipatam District." By Captain F. Applegath, Madras Army. Communicated by the President.

4. "On the Association of Granite with the Tertiary Strata near Kingston." By J. G. Sawkins, Esq., F.G.S. In a letter to Sir R. I. Murchison, F.G.S., &c.

The occasion of this letter was the discovery by the author of a granitic formation traversing Jamaica in a direction from S.E. to N.W., being the same as that of the earthquake shocks. It pierces the carbonaceous series, and also the tertiary strata, whence the author concludes that it is of the tertiary age. It usually contains copper ores, and is often more or less decomposed.

At a meeting of November 19th, Professor A. C. Ramsay, President, in the Chair—

James Brunlees, Esq., C.E., 5, Victoria Street, Westminster, and M. Auguste Laugel, Ex-Secrétaire de la Société Géologique de France, Orleans House, Twickenham, were elected fellows. The following communication was read:—

"On the Cambrian and Huronian Formations, with remarks on the Laurentian." By J. J. Bigsby, M.D., F.G.S.

This paper is divided into two parts, the first treating of the Cambrian formation, and the second of the Huronian. The author observed that the Cambrian is very local in its distribution, the Silurian in many cases lying directly upon metamorphic rocks; he made some remarks upon the mineralogical and stratigraphical characters of the first-named formation, the scarcity of its fossils, its conformable upward passage into the Silurian, and its absence in America and Northern Europe.

In the second part were described the Huronian of Canada, the Azoic Rocks of the southern shores of Lake Huron and Lake Superior, and the second Azoic group of Norway, all of which are considered by the Author to belong to the same period. It was then stated that the Huronian formation and its equivalents agree in being unconformable to the Silurian and conformable to the Laurentian, in containing many beds of limestone and a large quantity of Copper-ores, and in the total absence of fossils; in all of which respects they differ from the Cambrian. The author therefore came to the concusion that the Cambrian and the Huronian are distinct formations, and that the latter is very much the older.

At a meeting of the Council on November 19th Mr. Jenkins was appointed assistant-secretary in the room of Mr. T. Rupert Jones, who has filled that office for some time.

Mining, Quarrying, and Metallurgical Review.

CORNWALL AND DEVON.

The congratulations in which we indulged last month on the rise in the standards of tin-ore, have been very short-lived. So far from another advance taking place—which at the end of last month was daily anticipated, and even in some cases paid—the standards have dropped back nearly the whole of the recent rise, and in the prices of these ores are about as they were two months ago. This makes a vast difference to West Cornwall, and is a serious damper upon our spirits. The fall in the copper standard also continues, having gone back upwards of 5*l.* during the month. We all feel, however, that things might be worse; and considering the general state of our manufacturing industry, Cornwall after all has not much just reason to complain.

Of course the great subject of interest during the month has been the *Caradon District*. That this is an excellent district is not to be doubted; but the mania of which it has been the object during the last year, has been observed with profound regret by all well-wishers of Cornish Mining. The same game, which a few years ago ended in such disaster in the neighbouring district of Tavistock, is being played over again here. Mines which, although really good ones, have been worked up to prices which can only end in enormous losses, have been attempted to be put still higher; and numerous miserable little trials—entirely out of the productive district—are being palmed off at prices far higher than some of the best and most permanent dividends mines in the western part of the country are selling for.

Lead mines are generally looking well. *Cargoll*, a mine in the northern part of the county in Newlyn parish, adjoining East Wheal Rose, has considerably improved, and the first dividend of 1*l.* per share was declared a few days ago, after expending 7,000*l.* in erecting a new engine and machinery. East Rose paid 274,560*l.* in dividends; and Cargoll, in 916 shares, has called up scarcely 13,000*l.*, which may now be expected to be shortly returned in dividends. Mr. E. Michell, of Truro, formerly purser of East Rose, is the purser of Cargoll. The firm of which Mr. Michell is a member—that of R. Michell and Son, Lead Smelters—hold 200 shares; and 229 shares are held by the Bishop of Exeter, who is also interested as lord. In this same district, *West Chiverton*, has been working for some time privately with great success: indeed for the last two or three years it has been one among the four best lead mines in the county, but being worked privately little has been heard of it. The engine shaft is down nearly to the 80, and is sinking by 9 men. This shaft is sunk vertical all the way—in the country to the 60; from the 60 to the 70 it is on Williams's lode, but below the 70 the lode again passes out of the shaft. Susanna's shaft (45 fathoms to the east) is down to the 70. Some fine lead ground has been opened out in the 70, and the upper levels, upon one of the largest and finest lead lodes I have ever seen in the county. Besides Williams's lode, Valpy's lode and Elizabeth's lode are opening out well.

On this mine there is a 43″ engine; but 150 fathoms eastward of Susanna's there is an entirely new engine-shaft in course of sinking, on which a 60″ engine is being erected. This new shaft is now down 20 fathoms, and will take the lode at the 30. The manager and purser here is Captain James Juleff of Wheal Bassett, and the resident agent Captain Nancarrow.

Adjoining this on the east a new concern is being started on the same lode called *East Chiverton*. It has been sunk 20 fathoms by horse power, and two highly promising lodes cut. A new shaft is now commenced on which an engine is about being erected. This mine is also under the management of Captain Juleff, and is undoubtedly an excellent speculation.

Herodsfoot, and the old lead mines in the Liskeard district, are looking well. This district is more important for lead than it is generally taken to be: the killas is worthless for copper, but will produce many more lead mines.

Improvements have taken place in *West Seton* and *Uny*, both for copper, of some considerable importance. The ends in the former mine are greatly improved; and in the latter a bench of ore has been met with on the East Carn Brea lode.

Several new companies are announced in Cornwall. *North Pool*, in the Illogan district parallel with Carn Brea, is announced to be started; as well as *Tregurtha Downs* and Owen Vean in the Marazion district. In both cases the ground is good, and worthy of a good trial. Another mine in the latter district, called *South Grylls*, is also started, which now makes the fifth of the Grylls family—Wheal Grylls, East Grylls, West Grylls, North Grylls, and South Grylls. The only thing worth mentioning about South Grylls, is the fact that the promoters are to have 10,000*l.* for the sett! 100*l.* would be something nearer its value—for it possesses no intrinsic advantages over hundreds of other pieces of ground in the county, which not only can be had for asking, but which the proprietors are most anxious to get worked. Some of the parties connected with Wheal Neptune are associated with this. Certainly taking up mining setts, which can be had by the score for nothing, and selling them for 10,000*l.* ought to be a monstrously profitable business—but it has no relation to mining.

In contradistinction to this, we may refer to another concern coming out in Cornwall—*Wheal Curtis* in Crowan—for which no premium whatever is charged. As this sett is certainly in every respect preferable to South Grylls, it argues no small boldness on the part of the promoters of the latter to ask 10,000*l.* for their concern.

Although Somersetshire is beyond the limits of our heading, its metalliferous mines naturally group themselves with the great metallic mining districts of the West. Consequently we may refer here to the *St. Cuthbert* Lead Smelting Company, which is started with a capital of 75,000*l.*, in shares of 5*l.* each, for the purpose of working the slag deposits at Priddy Minery in the Mendip Hills. The property has been purchased for 65,000*l.*, and it is said that 100 tons of metallic lead may be returned monthly. Messrs. Phillips and Darlington are connected with the company. We shall take an opportunity, on an early occasion, of giving a notice of this district.

WALES AND THE BORDERS.

South Wales.—The general trade of the district of South Wales has been good, and there are indications, in connection with the iron trade, of still further prosperity. Additional furnaces are being erected in various localities, and those which have been out for many months are being relighted. We have not heard of an advance in price, but there is every reason to believe that should trade continue brisk, a material advance will take place in every description of iron at the commencement of the new year. There has not been a very large export trade during the month and by far the larger part of that exported went to Spain, Italy, and France.

The house coal trade is quite brisk, and the collieries are kept in regular employ. The steam coal trade is not quite so active as is generally the case at this time of the year. The colliers, however, are pretty regularly employed, and there is no room to complain.

The general export returns of coal shipped during the month of October will not bear comparison with the returns for the same month in last year, and this is chiefly accounted for by the boisterous weather that prevailed during the past month. From Cardiff, during the month of October, 1862, 102,862 tons of coal and 762 tons of coke were shipped;

from Swansea, 32,450 tons of coal; from Newport, 27,109 tons of coal—showing an increase over the quantity shipped in the same month last year of 2,082 tons—from Llanelly, 6,868 tons of coal. Of these quantities the following was sent to London and other ports in the United Kingdom:—From Cardiff, 71,643 tons of coal and 284 tons of coke; from Newport, 44,069 tons of coal; from Llanelly, 17,806 tons; and from Swansea, 13,532 tons.

The Pantyffynon colliery which has been at a stand for a great number of years, to the great loss of the neighbourhood, has been set in motion again by David Lloyd, Esq., of Blainea, in the parish of Llandebie.

At the Ebbw Vale Company's Abersychan works, a furnace was "blown in" a short time ago, and at Beaufort (Messrs. Bailey's) active preparations are being made to put another furnace in blast. At Aberdare, Maesteg, and Merthyr the ironworks are in active employ, and the men are nearly all working full time. The Rhymney Works promise to become one of the most important in South Wales. For some months past a large mill has been in course of erection for the express purpose of manufacturing iron plates, girders, &c. The company have determined upon this addition to their already extensive works in consequence of the demand for armour plates for coating vessels of war, &c., and to the general preference shown to iron over wood in the building of ships. When the mill is completed, employment will be afforded to a great number of additional hands, and it is pretty evident that Rhymney will soon be one of the most important localities in the South Wales mining district.

Mr. T. C. Hinde, the proprietor of the Troedyrhyw Colliery, Rhymney Valley, has taken the Onllwyn Iron Works, and the latter is now in full operation.

The following statistics respecting the district of Aberdare will be interesting from the importance of this district and its material influence on the statistical returns of the state of trade for the whole of South Wales The returns for the quarter ending the 30th September last, have just been issued, and it is satisfactory to find that the quantity of coal raised is in advance of the quantity raised in the previous quarter. The total quantity of coal raised in the parish of Aberdare for the quarter being 523,421 tons; of this quantity, 470,282 tons was exported and the remaining 53,139 tons were consumed at the iron works. The total quantity of coal raised during the previous quarter, ending the 30th of June, was 410,588 tons, showing an increase of 57,462 tons for exportation, and 2,132 tons for the works during the past quarter; a fact which proves not only that the various collieries in the district, have been actively employed, but that the iron trade has also shared in the prosperity of the district.

The following are the statistics of the trade of Swansea:—

The total number of vessels entering the port during the month of October, was 415, with an aggregate registered tonnage of 48,655 tons, and the total amount of shipping rates received was 1,172*l.* 19*s.* 6*d.* Of this number 209 vessels were engaged in the coasting trade, 188 vessels in the European trade, and 19 in the foreign trade. Compared with the returns of the corresponding month of last year there is a considerable decrease. In October, 1861, the number of vessels entering the port were 466, with an aggregate registered tonnage of 53,158 tons, showing a decrease during the past month of 50 vessels, and 4,503 tons. The whole of this falling off is in the coasting trade, the small vessels which usually make three or four voyages to and from the port in the month having been detained in consequence of the boisterous weather. The returns of the trade of the past month are the lowest since December, 1861, but the aggregate returns of the state of trade for the past ten months show a large increase over the corresponding period of 1861, or any previous year. With regard to the exports, there has been a good business, the total quantity of coal and patent fuel exported being 60,847 tons—42,285 tons foreign, and 18,562

coastwise; 800 tons of iron were also exported, the exports of both articles being considerably over those of the corresponding month of last year.

From the statistical returns of the trade of Neath during the past month, we find that the total number of vessels entering the port was 208, with an aggregate registered tonnage of 15,714, or a burthen tonnage of 24,700. Of this number 18 vessels with a tonnage of 1,379 tons were employed in the European trade, and 190 vessels, with a registered tonnage of 14,335 tons in the coasting trade. The imports were 9,298 tons, including 2,829 tons of copper ore, 741 tons pig iron, 391 tons iron ore, 706 tons timber and pit and cord wood, &c. The exports were 20,922 tons—19,083 tons coal, coke and culm, 228 tons copper, 1,171 tons bar iron, 201 tons tin-plates, and 246 tons miscellaneous goods.

The Glyn Neath Steam Coal and Iron Company, which has been formed on the limited liability principle, with a capital of 50,000*l.*, in shares of 1*l.* each, has just issued its prospectus. It is proposed to further develope certain well-situated collieries, located in the Vale of Neath, and known as the Pandy Collieries and the Abergwrelych Iron Ore and Coal Works, comprising together about 1,000 acres. The vendors are to receive for the works, leases, plant, machinery, &c., 20,000*l.* (five-eighths of which is to be in paid-up shares.) The pits are stated to be more favourably situated with regard to the port of shipment than the celebrated Aberdare steam collieries, and it is estimated that 500 tons of coal per day may be raised for double the term of the leases, and 26,000 tons of ironstone per annum may be worked for the next 35 years.

GLOUCESTERSHIRE.—Among the imports into Bristol during the month have been: 530 tons of pig-iron from Glasgow and Belfast; 260 tons of sulphur ore from Pomaron; 85 tons of silver lead ore from Tynemouth and 20 casks of lead ore and 200 galvanised standards from Liverpool. Among the exports were: 1,000 tons of various sorts of iron; 352 tons of coal; 180 tons of bitumen mineral for Santander; 20 lbs. of lead for Jamaica and 40 cwt. of copper manufactures for the West Coast of Africa.

MIDLAND COUNTIES.

DERBYSHIRE.—Although the home demand for iron has been less active, the trade is sound and healthy. There have been a large number of orders given out, principally for exportation, which, with those already on the books, will maintain the trade in a tolerably active state up to Christmas. For plates, bars, and some other descriptions of iron, there is an active demand, and a good prospect of its continuance. Pig-iron is firm, and the tendency of the market is upwards. The railway department of the trade is brisk, arising mainly from the extensive orders for iron for the renewal of permanent ways, to which all our leading railway companies are paying more attention than formerly. For railway springs there has been an unusually large demand. The manufacture of armour plates is going on unabated, and the only difficulty is to keep pace with it.

The coal trade has shown additional activity since our last, and the returns of the past month will bear favourable comparison with its predecessor. There are very few collieries but what are doing a good business. The demand from Lancashire is very dull, and less inquiry from the metropolis, the London merchants having laid in their stocks at the beginning of the autumn. There is a good enquiry for coke, and the ovens in Derbyshire are generally in full work, the great bulk of that manufactured at Dronfield going for steel smelting purposes at Sheffield. The demand for the Derbyshire hard steam coal is rapidly increasing, and at the collieries where it is produced it is eagerly bought up. The Chesterfield and Silkstone colliery is progressing, and the shafts are in a forward state.

In the mining district of the Peak of Derbyshire everything is exceed-

ingly quiet, chiefly on account of the depression which prevails, and which operates prejudicially to the investment of capital in new undertakings. The works at the North Derbyshire Mine are stopped, the shareholders being literally wearied out by continued calls. This is much to be regretted, because had this mine been proved well, it would have given such a stimulus to lead mining in Derbyshire which it never experienced before. As it is, the hopes of investors and shareholders are at a very low ebb, and the present failure of this great company operates much against the further development of the mining interest. The local mining share market has been dull and a very limited business transacted.

Staffordshire and Warwickshire.—Trade upon the whole has been in a satisfactory state in this district. The greatest demand has been for ship and girder building. Good bars have not been in such large request except those required to make up with the girder plates. Galvanised sheets have been in tolerably good demand, but there is now so much competition in the trade that the make is extended over a wide district of the country, and there is not so much, comparatively, being done now by some houses in this district as there was some months ago. The demand for the iron ores of the district is increasing. White iron-stone and gubbin are fetching from 14s. to 16s. per ton, according to quality. The demand for thick coal is brisk, but heathen and new mine coal are not so much in request. The stocks of thick coal which accumulated during the summer are all swept from the pit banks, and it is pretty evident now that the requirements for this particular sort of coal cannot be met. Considerable outlays are being made west of Dudley to meet the demand, but it will be some time before the pits are in a position to produce any large quantities. The notices of some of the thick coal colliers for an advance of 6d. per day have expired, and no doubt they will cease working, but as the movement is not general we very much question whether those whose notices have expired will stand out long; no doubt higher prices may be got for thick coal, but to raise the price before an advance is declared upon iron would be inflicting a burthen upon the iron trade and domestic consumers also, which, under existing circumstances, would be unjust. The colliers will do well to consider the importance of this before taking any decided course of action in reference to a rise of wages.

NORTHERN COUNTIES.

Northumberland and Durham.—The coal and iron trades of this district continue in much the same condition as when we last referred to them. The coal trade is improving in the household districts; but the northern steam coalpits are not very well employed. The gas and coking coal collieries continue pretty much the same. The iron trade maintains its position, and seems likely to keep it, for the present at least. The furnaces on the Tyne, Weir, and Tees, and in Cleveland, are nearly all in blast, and on the former river the Messrs. Palmer, of Jarrow, are about to erect extensive rolling mills.

The following data on blast furnaces are collated from an article on the iron trade of the north in the *Darlington and Stockton Times*:—

Nov. 1, 1862	58	in blast;	22	out of blast....	Total....	80
„ 1861	49	„	27	„	„	76
„ 1860	51	„	23	„	„	74
„ 1859	55	„	14	„	„	69
„ 1858	52	„	15	„	„	67
„ 1857	55	„	7	„	„	62

Showing a total increase since 1857 of 18 furnaces.

A valuable vein of lead has been struck on the eastern flank of Harwood valley, Durham, and about eleven miles from Alston. The sedimentary series of which this formation is composed has several productive beds which crop out along the hill from the coal sills above to the sear limestone below. It is in the rock last named that this discovery referred to has been made, and it is a singular fact that former miners have been working in a vein parallel to the one just found, at a distance of only three fathoms.

The exports for the Tyne during the month comprise:—96,935 tons of coal; 49,067 cwts. of iron, and 8,623 tons of coke. Among the imports were, 3,253 bars of lead from Carthagena and Garrucha; 16 tons of iron from Carthagena; a quantity of iron from Gothenburgh; 20 tons of zinc ore from Drammen; 20 tons of copper ore from Carthagena, and cargoes of pyrites from Pomaron, Gefle, and Antwerp.

The prospectus of the Brandon Walls Lead Mining Company has been issued. The capital has been fixed at 18,000*l*., in shares of 25*l*. each; and the property to be worked comprise the Brandon Walls, the Thorney Brow, and the Stottsfield Burn setts, at Stanhope, in the county of Durham, and bounded on the north, east, and west by the property of Mr. Beaumont. The property has been favourably reported upon by Mr. J. Hitchins and by Mr. Septimus Beardmore, the lease being for eighteen years, at a royalty of 1-12th for lead, and 6*d*. per ton for ironstone. For the transfer of the lease, plant, and machinery the vendors are to receive 7,000*l*., of which 3,000*l*. will be taken in fully paid up shares.

LANCASHIRE.—A company has been formed called the Sankey Brook Coal Company for the purpose of purchasing and thoroughly working the well known Sankey Brook Colliery, near St. Helen's, Lancashire. The mines to be worked extend under 270 acres, and it is stated that 14,000*l*. of the royalties have been paid in advance; of this the company will have the first realised moiety. The coal is a particular favourite with the Liverpool steam-ship owners, who prefer it to all other Lancashire steam coal. The St. Helen's Railway and St. Helen's Canal are both available for the transport of the coal. The colliery is at present in profitable operation, and is raising and selling upwards of 100,000 tons per annum. An immediate dividend of 10 per cent. is confidently anticipated, and as soon as the new works are completed, in 12 or 15 months, this percentage will be largely increased.

On November 1st the Bridgwater Trustees started a new pair of vertical high-pressure winding-engines, of 150 horse power, at the new colliery, Mosely Common.

The South Yorkshire coal trade for the month of September was scarcely as good as might have been expected from the business done the previous month—there being a marked falling off in the railway returns, especially with regard to the Silkstone. Most of the collieries, however, are doing a fair business, and the men are pretty fully employed. The Lancashire market continues dull, and with no prospect of being better. The demand for the metropolis is rather quiet.

The Methley coal strike has ended in a compromise, the terms being settled at 15*d*. for large and 11*d*. per ton for small coal, instead of 13*d*. per ton all round.

SCOTLAND.

Coals have been in fair request for home use, and in good demand for shipping, fully supporting previous rates.

The pig-iron market has been quiet but firm. The shipments for the month show a large decrease on the quantity shipped during the corres-

ponding month of last year, being 5,001 tons in November this year against 9,464 tons in the same month of 1861.

The demand for all kinds of manufactured iron continues good, particularly for plates and other shipbuilding iron. The late sale of so many of our Clyde steamers to the Confederate Government, and others concerned in running the blockade, has caused a great demand for new steamers, and given an impetus to this branch of trade. In common bar there is an unusual trade at this season of the year; makers are fully employed and prices steadily maintained. Most of the makers have orders in hand to carry them well over this year. For first class bars the price is still *7l.*; second-rate brands generally *6l.* *12s.* *6d.* per ton, usual discount f. o. b. here. A few of the second-rate makers are booking orders at *6l.* *15s.*; and we believe even at these prices it is difficult to contract forward to any extent makers generally believing in higher prices in the spring.

For some time exploring bores have been at operation near Baillieston, and the search has resulted in the disccovery of clayband ironstone of two feet in thickness. From the position in which it has been found there can be little doubt that it is identical with that recently found in Wood Hall. Should it not prove erratic in its character this will turn out a valuable discovery, as it lies in the immediate vicinity of all the great iron works of the districts.

At a meeting of the Glasgow Chamber of Commerce held on November 18th, Mr. Fleming read the following report by the Committee of the Chamber on the remit from the Board of Trade as to sulphur mines in Mexico:—

"The sulphur annually imported into Great Britain, on an average of the last ten years, may be stated at about 55,000 tons, while there is, in addition, a large yearly consumption of copper and iron pyrites, which, especially when sulphur reaches a high price, is extensively used in the manufacture of the sulphuric acid of commerce. We are indebted to the mines of Sicily for our supply of sulphur. Pyrites is chiefly found in Ireland and Wales; but of late considerable quantities of rich ore have been got from Spain. Sulphur is extensively used in the manufacture of gunpowder, and on the Continent it is much employed in preventing, or rather mitigating, disease of the vines. For such purposes there seems to be no substitute. Sulphur and pyrites are alike serviceable in the manufacture of vitriol—though that made from pyrites is inferior in quality to that obtained from sulphur. If sulphur could be got at *5l.* per ton, very little pyrites would be used in this country. The expense attending the mining and shipping of sulphur in Sicily has of late been increased by higher wages being paid for labour in that country. There is a small nominal export duty on the article in Sicily, but not to such an extent as materially to affect the cost. It is believed that *5l.* *10s.* a ton is as low as sulphur can be delivered in this country, so as to be remunerative to parties carrying on the trade. The price has been over rather than under this quotation during the last ten years, and the fluctuations arising chiefly from speculation have been very great—the lowest price, for thirds (in 1855), having been *4l.* *17s.* *6d.*, and the highest (in 1858), *10l.* per ton, delivered here. The value of pyrites depends necessarily on the richness of the ore—varying from 30 to 40 per cent. of sulphur—and the price may be stated at *30s.* to *40s.* a ton here. Regarding the question purely in a commercial view, it does not occur to the Chamber that sulphur could be mined and imported into this country from Mexico as cheaply as from Sicily, although the information obtainable on the point is necessarily meagre, as the precise locality of the sulphur mines is not given, nor have the extent and character of the mines been ascertained or proved. The cost of freight alone would appear to be a barrier to its being advantageously imported into this country in competition with Sicily. In the American markets, however, where the consumption of sulphur must be very considerable, the advantages in favour of Mexico might possible preponderate. The difficulty of finding labourers at a moderate rate in Mexico to carry on such an undertaking might also be a barrier to its success. The commercial aspect of the question is perhaps,

however, too narrow a view to take, and your committee are disposed to think that, politically regarded, the possession of an extensive and rich field of sulphur, such as seems to exist in Mexico, might prove a very valuable acquisition to Great Britain, and the present opportunity of obtaining a grant of the land (if practicable) should not be allowed to pass. So long as we are at peace with our neighbours, and have the Mediterranean open to our trade, our supplies of sulphur are not likely to be interrupted; but if, from any emergency, the Sicilian ports were closed or blockaded, the injury which this country would sustain might be very serious, and the manufacture of gunpowder, so requisite for the maintenance of our power would be wholly at a stand. America and other countries are equally interested with us in such a question, and if we do not take advantage of the offer which has been made, other parties may do so, and thus doubly disadvantage Great Britain. Looking at the question in this light, your committee are of opinion that Government should at once endeavour to obtain reliable information as to the extent and position of the sulphur mines, and that a purchase or grant of the property should be effected, unless the terms are extravagant or the conditions unreasonable. Upon these points your committee are not in a position, and it would probably be out of place for them at present, to offer any opinion."

The Chairman said that if that report were agreed to, then he supposed the best thing he could do was to send a copy of it to the Board of Trade. Mr. A. Gilmour remarked that the report seemed to him a clear and concise document, and he thought the Chamber was very much indebted to Mr. White, and especially to Mr. Connal, for the trouble they had taken in drawing it up. As it was stated in the report, he thought the Government should be requested to inquire into the particulars of the matter. They did not wish the Government to jump at it and purchase it at once; but the report showed that it was an important matter, and worthy of consideration. It seemed there was only one great source of supply at present, and this might be another. Now if anything shut them out from the present source of supply, it would be most important to have another source ready. He cordially agreed with the proposal to send a copy of the report to the Board of Trade. The suggestion was agreed to *nem. con.*

THE CONTINENT.

France.—The annual wood sales have now almost terminated in the eastern departments of France. From the transactions concluded thus far it is inferred that charcoal will be made available during the ensuing year at 10*s.* per cubic metre, showing a marked reduction as compared with the preceding year. The forges on the Haute-Marne being supplied on these terms have before them a tolerably satisfactory future, as the price of refined pig is sustained at 5*l.* 2*s.* at St. Dizier. At Maubeuge, quotations for the different numbers of refined pig range from 4*l.* to 4*l.* 4*s.*; this important metallurgical centre consumes, almost exclusively Belgian ores, importing them even from Louvain. At Lille, the competition of Belgian iron-masters is sharply felt. Staffordshire irons have been held at Harvre at 10*l.* 8*s.* per ton, and Welsh at 9*l.* 4*s.* to 9*l.* 12*s.* per ton., without classes. Swedish iron has been in good demand at 14*l.* 10*s.* without classes; this firmness has arisen from the rapidity with which the available stock has been run off, while, as the northern navigations are now closed, it cannot be replenished for some months.

Second-fusion pig is in little demand, the price of the Glosmartier mark remaining nominally at 6*l.*; this mark, which was formerly readily placed at Paris, in Franche-Compte, and Alsace, on the same footing, and often at a higher price than Gartsherrie pig, is now excluded from these markets by English competition, and can find a demand only within a very restricted radius. The proprietors of the Bayard Furnace are applying themselves—at any rate temporarily —to the production of pig for casting

purposes. Coke-pig for second fusion is a new speciality, which, by reason of the well known quality of the ores of the district, could be cultivated in it; but in order that the experiment might be tried with success, and in order that it might be possible to offer this kind of pig in competition with similar Scottish pig, cheap means of transport must be secured, and these are at present wanting.

BELGIUM.—There are satisfactory advices with reference to the Belgian coal trade. Great activity prevails with respect to deliveries of coke by railway and water; no mine has any coke stored up, and engagements have been entered into for 1863. Fine washed forging coals have also been in good demand by railway, and altogether prices have been firm. The men of some of the collieries of the basin are on strike, with a view to obtain an increase of wages, but hopes are entertained that this state of things will prove only partial, and that it will not exercise an adverse influence on the trade generally.

The annual report of M. Gonot, engineer in chief, and director of mines in the province of Hainault, supplies a great mass of information on the mining industry of that important district, the coal basin of which is divided into three groups, known respectively as the Couchant de Mons, the Centre, and the Charleroi. The first comprises the collieries situated to the west of the town of Mons as far as the French frontier; the second those which are found between that town and the river Pieton; and the third the collieries in the neighbourhood of Charleroi, from the Pieton to the eastern limits of the province. The extraction of coal in the whole of the province amounted last year to 7,935,645 tons against 7,506,720 tons in 1860, showing an increase of 428,925 tons, although the number of pits in work was reduced from 221 to 215.

Coal Markets.

LONDON.—From the Return of the Registrar of the London Coal Exchange, of the quantity of sea-borne Coal, Culm, and Cinders, imported into London in the month of October, we learn that the total quantity was 302,845 tons, against 299,560 tons during the corresponding month of last year, showing an *increase* of 3,285 tons. The total quantity imported during the ten months ended October 31st, was 2,770,459 tons against 2,879,532 tons during the corresponding period last year—showing a *decrease* of 109,073 tons.

The following are the particulars of the 302,845 tons imported during October:—

Newcastle ..	105,708 tons, in	297	ships	Scotland ..	3,074 tons, in	18	ships
Seaham ..	25,490 ,,	103	,,	Wales ..	9,047 ,,	27	,,
Sunderland .	86,052 ,,	223	,,	Yorkshire ..	4,646 ,,	89	,,
Middlesbro'.	6,413 ,,	27	,,	Small ..	1,592 ,,	4	,,
Hartlepool..	55,058 ,,	196	,,	Cinders ..	2,526 ,,	18	,,
Blyth ..	2,990 ,,	11	,,	Culm ..	249 ,,	1	,,

The quantity of coal imported by railways and canals during the month of October, was 135,416 tons against 152,016 tons during the corresponding month last year—showing a *decrease* of 16,600 tons.

At the end of October a large fleet which had for some time been expected came in. There was a large demand for all kinds of coal at advanced prices. Best house coal, 18*s*. 3*d*. to 19*s*. 6*d*.; seconds, 17*s*. to 18*s*.; Hartley's, 15*s*. 6*d*. to 16*s*. 6*d*.; manufacturers, 13*s*. to 15*s*. On the 3rd of

November there were few arrivals, and house coal was readily purchased at last prices: only one ton of Hartley's, which realised 17*s.* 6*d.* On the 5th the demand for house coal was good; Hartley's scarce at an advance of 6*d.* per ton. On the 7th there were few arrivals, and the colder weather having produced an active demand for house-coal, the whole quantity was cleared off at 3*d.* per ton higher. On the 10th the demand for house coal was good, and all that came to market was disposed of at slightly advanced prices. On the 12th the arrivals were few and the whole found ready purchasers at fully last prices. On the 14th the market for house coal was less firm but prices were maintained. On the 17th large arrivals caused an ample supply, and a large amount of business was transacted at a reduction of 3d. per ton on best sorts. Hartley's a little lower. On the 19th further arrivals caused a dull market and last prices were with difficulty obtained. On the 21st the market for house coal was dull at a reduction of 3d. per ton. Hartley's and manufacturers steady at last prices.

GENERAL EXPORTS OF COAL.—From Messrs. J. and J. Platt's Coal Circular for November, we find that the quantity of *coal, cannel, coke, and patent fuel shipped from Liverpool* to foreign and colonial ports during the month of October, was 50,747 tons against 56,758 tons in the corresponding month of 1861,—showing a *decrease* of 6,011 tons. The total quantity shipped during the ten months ending October was 523,222 tons, against 553,003 tons during the same period last year,—showing a *decrease* of 29,781 tons. The shipments coastwise during the month of October amounted to 8,571 tons, against 10,391 tons during the corresponding month last year, showing a *decrease* of 1,820 tons. The total quantity shipped coastwise during the ten months ending October was 69,206 tons, against 73,502 tons during the same period last year,—showing a *decrease* of 4,296 tons.

The oversea exports of coal from Bristol during the month of October amounted to 504 tons, against 1,429 tons during the same month last year —showing a *decrease* of 925 tons. The total quantity exported during the ten months ending October amounted to 10,160 tons against 14,279 tons during the same period last year,—showing a *decrease* of 4,119 tons.

Notwithstanding the commercial depression produced by the war, the exports of coal to the United States during the first nine months of this year have exceeded those of 1859 and 1860. The amount exported during the nine months ended September this year was 252,985 tons, against 249,736 tons during the corresponding period of 1860, and 127,592 tons in 1859,—showing an increase respectively of 3,249 and 80,393 tons.

Metal Markets.

THE metal market has been very dull all through the month; with few exceptions all prices have been depressed, and the prospects of an improvement seem to grow more and more distant. The market appears to have been mainly sustained by the Colonial and Continental trades.

IRON.—The iron trade has been pretty active during the month, and towards the end a considerable business was done.

At the end of October the Scotch pig-iron market was steady and some business reported at prices ranging from 55*s.* 9*d.* to 56*s.* 6*d.* Towards the middle of November a demand sprung up and a good business was done between 56*s.* 3*d.* and 56*s.* 9*d.* Towards the end of the month the demand assumed a more speculative character, and at one time 56*s.* 9*d.* to 57*s.* 6*d.* were realised, but prices afterwards gave way 6*d.* per ton in consequence of

the heavy realisations at the advanced prices, and the market closes not quite so firm. The exports during the month amounted to 29,998 tons, against 42,911 tons the same month last year, showing a *decrease* of 12,910 tons.

Rails have been in fair demand; in the middle of the month they were quoted firmly at 5*l*. 15*s*. to 6*l*. in Wales, but becoming less in demand prices somewhat receded, and leave off 5*l*. 12*s*. 6*d*. to 5*l*. 15*s*. at the works. Merchant bars have been in request and the price steady at 6*l*. in Wales, 6*l*. 10*s*. to 6*l*. 15s. delivered f. o. b. in London. Staffordshire descriptions of best brands have had a good sale; the makers have been in full work, and firm at list prices: common bars have been more inquired for since the advance in Welsh. In Swedish bars a considerable business has been doing, a large quantity having changed hands, both for arrival and on the spot, at 11*l*. 10*s*. to 11*l*. 15*s*., according to specifications.

STEEL.—Swedish Keg has been steadily maintained at 16*l*. Some arrivals have taken place, but the greater portion has been purchased for re-shipment.

COPPER.—The market for English has been very quiet and the business done exceedingly limited, and manufactured could have been bought at prices under fixed rates. Cake, tile, and ingot have been in fair request at firm prices. The demand for foreign has been very limited and prices have declined from the quotations we gave last month; the last rates being—Kapunda 101*l*., Chili 87*l*., and Spanish 88*l*. to 89*l*.

YELLOW METAL.—Sales for shipment of this article have been very limited and prices have receded. Braziery sheets have been sold as low as 8*d*., and contracts for sheathing have been passed at 8¾*d*., although full price is generally quoted by the makers.

TIN.—At the beginning of the month English was in good demand and a fair amount of business was done. Towards the end of the month however, the demand became very slack, and on the 19th the smelters reduced the price of refined and common 4*l*. per ton, making the quotations, refined 120*l*., bars 116*l*., block and ingots 115*l*.

In foreign the speculative feeling of last month has entirely subsided, and hardly any business has been reported. Straits, 117*l*. 10*s*.; Banca, 119*l*. The Dutch market has been quiet at 69 f.

TIN PLATES.—There is nothing new to report in this article; there has been a moderate demand without any alteration in prices.

LEAD.—During the month common English pig has been in good request, and quotations advanced to 21*l*. for common, and 21*l*. 10*s*. to 21*l*. 15*s*. for W. B. Shot and sheet have been very little inquired for. Pipe and red have been in fair request. Bars have been more in demand at 21*l*. 15*s*. Spanish pig, 20*l*. 5*s*. to 20*l*. 10*s*.

SPELTER.—In the beginning of the month this metal underwent an entire change; weak holders wanting to realise, forced the prices down to 21*l*. *s*. 6*d*. This decline received an additional impetus by the large arrivals which took place towards the end of the month; and prices gradually declined to 17*l*. 10*s*. to 17*l*. 15*s*. W. H. 18*l*. 7*s*. 6*d*., at which rates the closed.

Metallic-Ore Markets.

THE standard for black tin has receded 8*l*. on the prices we gave last month, and now stands at—

Superior Fine	.. £107	....	Superior Common	..	£103
Second Fine	.. 105	....	Second Common	..	102

The rapid rise of 10*l.* which we noticed last month in the standard of black tin, instead of being followed by another advance which we stated was then generally expected, and indeed in some cases realised, has resulted this month in a decline almost as rapid. These sudden changes do not betoken a healthy position of this metal, and injuriously affect the mining interest. The first fall from the standard quoted in our last was on the 11th, when there was a reduction of 3*l.* This was followed on the subsequent week—on the 18th—by another reduction of 3*l.*: the last reduction 2*l.* being on the 26th.

Copper.—At the four Cornish sales we give this month, the number of tons, average produce, quantity of fine copper, average price per ton, and standard have been as follows:—

Date.		*Tons.*		*Produce.*		*Fine Copper.* Tons. cwt.		*Price per ton.*		*Standard.*
Oc 30.	..	2,310	..	6¾	..	154 13	....	£5 8 6	....	£122 3 0
Nov. 6.	..	3,819	..	6⅜	..	244 11	....	5 3 6	....	123 19 0
„ 13.	..	3,041	..	6½	..	197 3	....	5 4 6	....	122 19 0
„ 20.	..	6,246	..	5¾	..	358 18	....	4 9 0	....	125 10 0

Comparing the standards of copper ore, we have again to notice a tendency to decline. At the sale of November 6th there was a decline of 2*l.* The standard then remained stationary till the sale of the 20th, when there was another drop of 1*l.* 15*s.* according to the *West Briton*, but of 2*l.* 10*s.* according to the *Mining Journal.* The total decline during the month has been respectively 3*l.* 15*s.* and 4*l.* 10*s.* according to the authority followed.

Lead.—Comparing the sales of lead ore this month with those of last, it will be seen that there has been an average advance in price of about 12*l.* per ton.

London Share Market.

The general business of the London share market has been almost without interest, all attention having been absorbed in the great and sudden fluctuations of East Caradon.

East Caradon opened flat at 44–45. They continued much at this rate but in better demand until the 5th when they declined 1*l.* per share. They continued very dull and gradually receded in price until the 12th, on which day they had dropped as low as 34–35 at which price they were dull. From this they rallied slightly, but again fell, and on the 17th were quoted at 32–33, since which they have fluctuated between 33–34 and 35–36. *West Caradon* 32–34. *South Caradon* 380–400. *Gonamenas* have been in request at 2½–2¾. *South Caradon Wheal Hooper* 17*s.*–19*s.* *Wheal Pollard* 11*s.*–13*s.*

Marke Valley has fluctuated considerably during the month, and has declined 2*l.* per share. They opened at 10⅛–10⅜ at which price they were firm until the middle of the month when they began to recede, falling to 8–8½, from which they have since rallied, and close at 9½–10. *North Phœnix* 6⅛–6¾. *South Phœnix* 2½–3. *West Rose Down* 17–18.

After East Caradon the mine most dealt in has been *North Roskear* which has experienced a heavy fall. Shares opened firm at 51–53. From this they have gradually receded, and have declined

altogether 15*l.* per share or 10,000*l.* for the mine. *North Croftys* have experienced a similar fall, having receded from $6\frac{5}{8}$–$6\frac{7}{8}$, at which they opened with a large business doing, to $3\frac{7}{8}$–4 at which they close. *Wheal Emily Henrietta* declined to 9, but close at 10–$10\frac{1}{2}$.

West Setons have advanced considerably during the month. They opened at 250–260 and close at 285–290. *Wheal Setons* have been quiet at 162–166. *New Seton* 140–150. *South Seton* 16–18.

Great Wheal Fortunes have had a rise, but it has not been quite maintained. They opened at 26–27, with an active business doing. They remained firm at this rate until the 13th, when they rose into great demand, with a large business doing at 30–31. The drop in tin however has had a slightly depressing effect and they close 29–30. *Calvadnacks* have been in demand at advanced prices. They opened at $5\frac{3}{4}$–$6\frac{1}{4}$ and close at 6 $\frac{1}{2}$–7. *Wheal Grylls* 27–28.

Tincrofts have been in request at slightly advanced rates. They opened $12\frac{1}{2}$–13 and close $13\frac{1}{4}$–$13\frac{3}{4}$. *Cook's Kitchens* opened firm at 31–32 but have receded to 29–30. *Condurrows* have been in active demand in consequence of an improvement, and shares have advanced from 80–90 to 95–100. *Dolcoath* 560–570.

East Bassets have been flat at slightly receding prices. They opened at $52\frac{1}{2}$–55 and close 51–52. *Wheal Basset* 80–85. *Wheal Buller* $52\frac{1}{2}$–$57\frac{1}{2}$. *North Basset* 8–$8\frac{1}{2}$.

East Carn Breas have been considerably dealt in, but shares have slightly declined. They opened at $13\frac{1}{4}$–$13\frac{3}{4}$ and close at $12\frac{1}{2}$–$12\frac{3}{4}$. There has been a large demand for *Great South Tolgus* and shares have advanced from $5\frac{5}{8}$–$5\frac{7}{8}$ at which they opened, to $6\frac{1}{2}$–$6\frac{3}{4}$ at which they close. *Wheal Unys* have slightly advanced in consequence of an improvement in the 58 west. They opened 7–$7\frac{1}{4}$ and close $7\frac{1}{4}$–8. *Wheal Unions* have been flat at 6–$6\frac{1}{4}$. *South Carn Brea* $2\frac{1}{2}$–$2\frac{3}{4}$.

Herodsfoots have considerably advanced in price during the month. They opened 42–44 and close 46–47. *Wheal Trelawnys* have advanced a little on last month's rates. They opened at 16–$16\frac{1}{2}$ and close at17–$17\frac{1}{2}$. *Wheal Mary Ann* 15–16.

In *Lady Berthas* a considerable business has been doing at prices ranging from 27*s* to 29*s*. *Devon Great Consols* 490–500. *Kelly Bray* 10*s*.–12*s*. 6*d*. *Drake Walls* 17*s*. 6*d*.–19*s*.

The Lelant mines have all declined in price. *Providence* opened at 44–45, and close at 40–42. *Wheal Margarets* opened at 43–44 and close at 40–41. *Rosewall Hill and Ransome United* $3\frac{1}{2}$–4.

South Frances, which were in demand at the beginning of the month at $102\frac{1}{2}$–$107\frac{1}{2}$, have declined in price and close flat at $87\frac{1}{2}$–$92\frac{1}{2}$. *West Frances* 14–15. *Wheal Grenvilles* have slightly declined from $5\frac{1}{4}$–$5\frac{1}{2}$ to $4\frac{3}{4}$–5. *East Grenville* 55*s*.–57*s*.

West Tolgus have risen into demand in consequence of an improvement in the shaft, and shares have advanced from 49–51 to 55–57. *North Downs* have been flat at declining prices. They opened 3–$3\frac{1}{4}$. and close at $2\frac{1}{4}$–$2\frac{5}{8}$. *North Treskerbys* $3\frac{3}{4}$–4.

Cargolls have been in large demand at a great increase in price. They opened 23–25, and have been advancing all the month closing at 30–32. *East Rosewarnes* $2\frac{1}{4}$–$2\frac{1}{2}$. *Gurlyn* $2\frac{1}{2}$–3.

Clifford Amalgamated have declined from 23–25 to 21–22. *Clijah and Wentworth* 5–$5\frac{1}{2}$. *West Damsel* 75–80.

Pendeen Consols have receded from 6½–7 to 5½–6. *Wheal Kitty*, St. Agnes, have not been so firm as last month, and were quoted at 4–4¼. *Wheal Kitty*, Lelant, 8½–9. *West Polmear* 5*s.*–7*s.* 6*d.*

Transactions have also been reported in the following mines: *Great Retallack*, 12*s.* to 30*s.* *East Russell*, 2⅜–2⅝. *South Herodsfoot*, 2–2½. *Tolvadden*, 3¼–3½. *Pedn-an-drea*, 13*s.*–15*s.* *Wheal Unity*, 12*s.* 6*d.*–17*s.* *Wheal Crebor*, 8*s.*–10*s.* *Sortridye Consols*, 8*s.*–10*s.* *Carn Brea*, 67½–72½.

In colonial and foreign mines, prices have been quoted as follows:—*Port Phillip* 1½. *Yudananutana* from 3⅜–3⅝ to 3⅞. *Great Northern Copper* of South Australia ½–⅝. *United Mexican* opened 5½–5⅝, and closed 5⅜–5½. *Linares* 7⅜. *St. John Del Rey* opened 59⅝–60½, and closed 60–60½. *Cobre* 21–21½. *East Del Rey* 1½–1⅜. *Scottish Australian* ⅞–1. *Worthing* ½. *Monte Auros* 2⅛–2¼. *Santa Barbara* 1⅛–1½. *Kapunda* 1⅛–1¼. *Mariquita* ¾–⅞. *General* 21. *Capula* ⅝. *East Del Rey* 1½–1⅜. *Dun Mountain* ½–⅝. *Bon Accord* ½.

New undertakings have been quoted at the following prices: *St, Davids's Gold* ⅛–¾ prem. *Sovereign* par to ⅛ prem. *Dolfrwynog* ⅛–⅜ prem. *St. Cuthbert* ¼–¾ prem. *Nova Scotia Gold* ¼–½ prem. *Otea* ⅛–⅜ prem. *Quebrada* 1.

Provincial Share Markets.

Dublin.—The following is condensed from the *Mining Journal*:—

The market has been very firm all through the month, and a considerable amount of business has been done. *Wicklow Copper* shares have been in demand: they opened at 36-36½ but soon advanced to 38¾-38⅞ buyers. *Carysforts* opened at 19*s.* 6*d.*, with buyers for the account at 20*s.* After advancing to 21*s.* they receded to 20*s.* in consequence of the large number on sale, and leave off in demand at that price. *Mining Company of Ireland* shares have been steady at 19¾ to 19½. In *General Mining Company for Ireland* there have been but few transactions at prices ranging from 5¼ to 5⅜. More confidence is felt in *Connorees* which have been freely bought at 22*s.* to 22*s.* 6*d.* This company held on November 8th an extraordinary general meeting of shareholders, Dr. Waller in the chair, for the purpose of obtaining the shareholders sanction to authorise the directors to apply to the Board of Trade to exchange the registered office of the company from London to Dublin, pursuant to the provisions of the Companies Act, 1862. The resolution, which will save time and expense to the Company, was carried unanimously.

Cornwall.—The following is condensed from the *West Briton*:—

Wheal Emily Henriettas opened at 11½-12½ at which they continued steady for some time, but receded towards the end of the month to 11½, leaving off 10-10½. *East Pool* opened at 390-395 at which they were enquired for. They advanced towards the end of the month to 400-405 at which they close firm and are likely to go higher. *Wendron Consols* have been firm at 11½-12. *South Tresavean* opened 6¾ but suddenly advanced to 15 and then as suddenly dropped to 12. There appears to be a want of confidence in the lode. Towards the end of the month they went back to 9½-10 at which they were in good demand. *South Crofty* 13-13¼. *Copper Hill* 60-62½. *East Alfred* 5-12*s.* 6*d.* *Wheal Reeth* 20-35. *Trelyon Consols* 14½-15.

Tabular Abstract of Mining Accounts for the Month.

Date of Meeting.	Name of Mine, and Number of Shares.	Balances. Debit.	Balances. Credit.	Calls. Per Share.	Calls. Total.	Dividends. Per Share.	Dividends. Total.
		£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
	CORNISH AND DEVON MINES.						
Oct. 20	West Stray Park (1,056)	840 7 7	—	0 17 6	924 0 0	—	—
„ 22	Wheal Sidney (4,096)............	1,881 18 10½	—	0 8 0	1,638 8 0	—	—
„ 23	Falmouth and Sperries (2,000)	527 0 0	—	0 5 0	500 0 0	—	—
„ 23	West Jane (10,000)...............	23 15 11	—	—	—	—	—
„ 23	North Jane (2,000)...............	67 14 11	—	—	—	—	—
„ 23	East Jane (6,145)	—	—	0 3 6	1,075 7 6	—	—
„ 23	Hingston Down (6,000).........	—	178 15 4	0 1 6	450 0 0	—	—
„ 23	Wendron Consols (5,000)	463 9 11	—	—	—	—	—
„ 24	Gawton (4,000)	—	0 2 5	0 2 0	400 0 0	—	—
„ 24	Lady Bertha (6,000)	—	455 15 4	0 2 0	600 0 0	—	—
„ 27	Alfred Consols (4,943)	1,738 13 10	—	0 7 0	1,730 1 0	—	—
„ 28	Pendeen Consols	—	126 7 10	—	—	—	—
„ 28	East Carn Brea (6,000).........	34 9 9	—	—	—	—	—
„ 29	Great Fortune (1,798)	—	2,730 19 11	—	—	0 10 0	899 0 0
„ 30	Pedn-an-drea (8,465)............	678 17 3	—	0 2 0	846 10 0	—	—
Nov. 3	South Frances (496)	—	3,080 6 6	—	—	2 0 0	992 0 0
„ 4	Grambler & St. Aubyn (486)	221 1 0	—	1 0 0	486 0 0	—	—
„ 5	Condurrow (256)..................	1,710 19 10	—	—	—	—	—
„ 5	North Dolcoath (5,000).........	163 13 9	—	0 2 0	500 0 0	—	—
„ 5	Treweatha (4,096)	—	—	0 2 6	512 0 0	—	—
„ 5	Stray Park (920).........	641 5 5	—	0 14 0	644 0 0	—	—
„ 6	East Grenville (6,000)	—	249 17 0	0 2 6	750 0 0	—	—
„ 6	Calvadnack (915)	1,215 0 2	—	1 6 0	1,189 10 0	—	—
„ 6	West Frances (512)	896 14 7	—	2 0 0	1,024 0 0	—	—
„ 7	Bedford Consols (4,000)	74 0 8	—	0 1 6	300 0 0	—	—
„ 7	New Treleigh (6,000)............	2,154 10 6	—	0 5 0	1,500 0 0	—	
„ 10	Molland (5,000)	64 4 3	—	0 1 6	375 0 0	—	—
„ 10	Carnewas (4,370)	67 10 11	—	0 5 0	1,092 10 0	—	—
„ 11	North Roskear (700)	733 0 8	—	1 0 0	700 0 0	—	—
„ 14	North Crofty (5,610)	1,176 14 7	—	0 2 0	561 0 0	—	—
„ 12	Bampfylde (10,000)...............	554 10 3	—	—	—	—	—
„ 14	East Seton (5,610)	111 14 5	—	0 1 0	280 10 0	—	—
„ 17	Emily Henrietta (1,024)	—	67 8 9	0 10 0	512 0 0	—	—
„ 17	North Grambler (1,366)	220 0 0	—	0 7 6	512 0 0	—	—
„ 18	South Herodsfoot (1,024)	205 6 0	—	0 10 0	512 0 0	—	—
„ 20	Wheal Trelawny (1,040)	—	724 18 1	—	—	0 10 0	520 0 0
„ 20	Wheal Grenville (6,000)	554 15 3	—	0 2 0	600 0 0	—	—
„ 21	Devon Great Consols (1,024)	—	35,210 4 1	—	—	10 0 0	10,240 0 0
	WELSH & OTHER MINES.						
Oct. 23	Bryntail (1,960)	281 0 0	—	0 4 0	392 0 0	—	—
„ 27	Bronfloyd (5,000)	—	615 19 4	—	—	—	—
Nov. 7	Nant-y-Iago (2,400)	360 0 0	—	—	—	—	—
„ 11	Minera (1,800).....................	—	—	—	—	7 0 0	12,600 0 0
„ 12	Harwood (6,400)..................	—	54 11 1	—	—	—	—
	FOREIGN MINE.						
Nov. 18	Copiapo (10,000)..................	—	5,929 0	—	—	0 10 0	5,000 0 0

Prices Current of Metals.

From Messrs. JAMES and SHAKSPEARE'S, 10, Austin Friars, E.C.

			Per Ton.		
IRON	Bars	in Wales	£5 15 0	@	£5 17 6
	„	„ Liverpool	6 7 6	„	6 12 6
	„	„ London	6 15 0	„	7 0 0
	Nail Rods	„ Wales	—	„	6 10 0
	„	„ Liverpool	6 15 0	„	7 0 0
	„	„ London	7 0 0	„	7 10 0
	Hoops (Staffordshire)	„ Liverpool	—	„	8 0 0
	„ „	„ London	8 7 6	„	8 10 0
	Sheets „	„ Liverpool	8 15 0	„	9 5 0
	„ „	„ London	9 5 0	„	9 10 0
	Bars „	„ Liverpool	—	„	7 0 0
	„ „	„ London	7 7 6	„	7 10 0
	Scotch Pig (No. 1. g.m.b.)	the Clyde	2 16 0	„	2 16 6
	Rails	in Wales	5 17 6	„	6 0 0
	Russian	C.C.N.D.	—	„	—
	Swedish—Hammered—large sizes		—	„	11 5 0
	„ „ Indian sizes		—	„	11 10 0
STEEL	Hammered—faggot		—	„	16 10 0
	„ in kegs ½ and ⅝ in.		—	„	15 10 0
COPPER	Australian and other *fine* Foreign		99 10 0	„	100 0 0
	Foreign Slab, for Prod. 96 per Cent.		87 0 0	„	88 0 0
	English Tile and Tough		96 0 0	„	98 0 0
	„ Best selected		99 0 0	„	101 0 0
	„ Sheets, Sheathing and Rod		102 13 4	„	105 0 0
	„ Flat Bottoms		107 10 0	„	110 0 0
			Per lb.		
YELLOW METAL	Sheets, Sheathing and Rod		—	8¾*d*.	9¼*d*.
			Per Cwt.		
TIN English	Common Blocks and Ingots		—	„	115*s*.
	„ Bars (in barrels)		—	„	116*s*.
	Refined		—	„	120*s*.
Foreign	Straits, Fine		117*s*.	„	118*s*.
	Banca		118*s*.	„	119*s*.
			Per Box.		
TIN PLATES at Liverpool 6*d*. Less	Charcoal IC, best		—	„	29*s*.
	„ IX „		—	„	35*s*.
	Coke IC		23*s*.	„	24*s*. 6*d*.
	„ IX		29*s*.	„	30*s*. 6*d*.
			Per Ton.		
LEAD	Sheet		—	„	21 10 0
	Pig—W.B.		—	„	21 15 0
	„ Ordinary brands		21 0 0	„	21 5 0
	„ Foreign, soft		—	„	20 5 0
	Red		—	„	22 0 0
	Shot		—	„	24 0 0
	Dry White		—	„	27 10 0
SPELTER	(Cake)		17 15 0	„	18 0 0
ZINC	(Sheet)		—	„	23 10 0
			Per Bottle.		
QUICKSILVER	(in bottles containing 75lbs. each)		—	„	7 0 0
			Per Ton.		
REGULUS OF ANTIMONY	French Star		—	„	43 0 0

The Market has been inanimate during the past week.

COPPER.—English very quiet. Foreign slightly easier, with a reduction of about 20*s*. per ton in Australian, at which some few sales have been made.

TIN.—The mail just received from Singapore, bringing advices of large transactions for China and Japan at advanced rates (the quotation being 31 dollars, equal to about 134*s*. in warehouse here) has somewhat stiffened the market for Straits. There are buyers at 116*s*. with three months' prompt, and this price cash was paid yesterday afternoon for a fair quantity.

SPELTER.—The quotations are nominal, and scarcely buyers or sellers thereat.

Copper Ores.

Sampled Oct. 15, and sold at Tabb's Hotel, Redruth, Oct 30.

Mines.	Tons.	Purchasers.	Price.		
Great Wheal Busy......	89	8	£2	7	6
	75	7	2	5	0
	68	10	3	10	6
	67	7, 8	3	4	0
	56	2	4	9	6
	48	9	4	5	0
	25	1	1	13	0
	21	9	5	17	6
South Garadon	93	2, 6, 11	6	6	0
	77	3	8	11	6
	76	7	8	4	0
	57	3	6	8	6
	53	1, 2	15	13	6
	47	1	16	16	6
	30	1, 3, 10	6	1	6
Fowey Consols	82	1	6	13	6
	79	1	5	10	6
	78	1	5	10	6
	76	1	6	8	0
	40	5	6	0	6
West Damsel	72	3, 6	5	3	6
	71	3	6	14	6
	67	6	4	0	0
West Damsel	59	3	£1	9	0
	49	6	4	9	0
	36	3	1	6	6
Clifford Amalgamated	106	6, 9, 11	5	4	0
(United Mines)	70	10	1	0	0
	53	7	3	4	6
	27	1	0	13	6
Craddock Moor	64	2, 7	6	13	0
	46	11	7	10	0
	27	6	5	15	0
	25	10	4	8	0
Great Brigan	50	6	5	14	0
	38	5, 13	7	0	6
South Crinnis	43	6	4	12	0
	37	5	4	13	0
North Grambler.........	40	6	5	13	6
	33	5, 6	5	8	6
Falmouth and Sperries	25	1, 5	2	10	0
Grambler & St. Aubyn	24	5	6	3	0
Cuddra	5	5	7	16	0
West Par Consols	5	5	8	10	6
Wilton's Ore	2	9	8	11	6

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.		
Great Wheal Busy	448	£1,448	19	6
South Caradon	433	3,982	8	0
Fowey Consols	356	2,140	4	0
West Damsel	354	1,467	11	6
Clifford Amalagamated...	256	810	7	0
Craddock Moor	162	1,051	17	0
Great Brigan	88	551	19	0
South Crinnis	80	£369	17	0
North Grambler	73	406	0	6
Falmouth and Sperries	25	62	10	0
Grambler and St. Aubyn ...	24	147	12	0
Cuddra	5	39	0	0
West Par Consols...............	5	42	12	6
Wiltons's Ore	2	17	3	0

EACH COMPANY'S PURCHASE.

		Tons.	Amount.		
1	Vivian and Sons	463	£3,256	16	9
2	Freeman and Co.	144¼	1,077	12	3
3	Grenfell and Sons	346	1,826	7	6
4	Crown Copper Co	—	——		
5	Sims, Willyams & Co. ...	159	896	10	3
6	Williams, Foster & Co....	394 5-6	2,095	0	11
7	Mason and Elkington ...	269½	1,290	17	7
8	Bankart and Sons	122½	318	11	6
9	Copper Miners' Co.	106⅓	528	5	2
10	Charles Lambert	173	480	9	0
11	Newton, Keates & Co....	112½	724	0	8
12	Sweetland, Tuttle & Co.	—	——		
13	Neath Copper Co.	19	163	9	6
	Total..................	2310	£12,538	1	0

Average Produce, 6⅜.
Quantity of Fine Copper, 154 tons 13 cwt.

Average standard £122 3 0
Average Price per ton 5 8 6

Copper Ores.

pled Oct. 22, and sold at Tabb's Hotel, Redruth, Nov. 6.

Mines.	Tons.	Purchasers.	Price.	Mines.	Tons.	Purchasers.	Price.
Clifford Amalgamated	117	1, 7	5 10 0	South Frances	69	5	5 6 0
(Wheal Clifford)	105	7, 9	5 8 6		65	5, 7	5 1 0
	102	9	4 19 6		64	5	5 4 0
	100	7, 12	3 9 6		20	5	12 11 0
	94	11	6 13 6	East Pool	91	2	5 10 0
	90	3	5 18 0		69	6, 13	5 9 6
	81	2, 6	3 9 0		56	2	5 10 0
	76	12	4 1 6	Wheal Grenville	54	1	4 12 6
	59	9	4 10 0		46	1, 5	11 8 6
	32	3	4 10 6		45	5	6 0 0
West Seton	89	10	2 16 0		40	1	3 0 6
	82	3	8 17 6		28	1	3 11 6
	80	2, 7	4 18 0	South Tolgus	63	9	5 3 0
	66	3	7 1 6		53	7	5 3 0
	67	5	7 17 0		51	10	3 14 6
	50	1	6 19 6		44	3	7 4 6
	48	3, 5	5 3 0	Tolcarne	60	7	3 8 6
	31	3	8 17 6		49	1	5 18 6
	30	8	0 3 6		40	1	4 15 6
Wheal Seton	34	7	4 7 0		23	12	3 16 6
(Pendarves)	107	1	0 3 6	Wheal Basset	51	13	5 15 0
	85	7	4 0 0		46	13	5 8 6
	64	7	6 12 0		45	1	9 0 6
	43	9, 11	6 10 6		29	13	8 5 6
	24	3	15 4 0	East Basset	50	8	4 12 6
	5	6	2 19 6		35	9	4 7 0
Tywarnhaile	89	6	2 5 6		28	8	7 11 6
	79	10	2 6 6	North Crofty	69	10	1 6 6
	65	2, 8	0 2 6		24	3	6 5 0
	37	10	2 3 0	West Stray Park	70	1, 5	6 3 6
North Roskear	48	1	8 14 6	Wheal Harriett	33	10	1 10 6
(Enys)	45	5	9 15 6		25	6	4 12 0
	35	1	10 15 6	Tresavean	12	5	2 2 6
	25	3, 10	2 12 6		7	5	2 9 0
(Pendarves)	40	8	4 4 6	East Grenville	13	1	2 13 0
(Basset)	26	8	4 4 6	North Dolcoath	12	9	6 8 6

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.		Tons.	Amount.
Clifford Amalgamated	856	£4,226 19 6	Tolcarne	172	£774 16 0
West Seton	583	3,159 13 6	Wheal Basset	171	1,188 18 0
Wheal Seton	362	1,589 3 0	East Basset	113	595 12 0
Tywarnhaile	270	863 16 6	North Crofty	93	241 8 6
North Roskear	219	1,560 5 6	West Stray Park	70	432 5 0
South Frances	218	1,277 15 0	Wheal Harriett	58	165 6 6
East Pool	216	1,186 5 6	Tresavean	19	42 13 0
Wheal Grenville	213	1,266 8 0	East Grenville	13	34 9 0
South Tolgus	211	1,105 5 6	North Dolcoath	12	77 2 0

EACH COMPANY'S PURCHASE.

	Tons.	Amount.		Tons.	Amount.
1 Vivian and Sons	625½	£3,356 16 0	9 Copper Miners' Co.	345	1,751 17 0
2 Freeman and Co.	260	1,343 5 9	10 Charles Lambert	370½	876 19 3
3 Grenfell and Sons	429½	3,134 14 9	11 Newton, Keates & Co.	115½	767 14 9
4 Crown Copper Co.	—	—	12 Sweetland, Tuttle & Co.	149	571 8 6
5 Sims, Willyams & Co.	433½	2,916 2 0	13 Neath Copper Co.	160½	971 13 3
6 Williams, Foster & Co.	194	660 16 9			
7 Mason and Elkington	529½	2,529 3 9	Total	3819	£19,807 2 0
8 Bankart and Sons	206½	926 10 3			

Average Produce, 6⅜.
Quantity of Fine Copper, 244 tons, 1½ cwt.

Average Standard £123 10 0
Average Price per ton 5 3 6

Copper Ores.

Sampled Oct 29, and sold at Tabb's Hotel, Redruth, Nov. 13.

Mines.	Tons.	Purchasers.	Price.
East Carn Brea	62	9	£6 12 0
	57	10	4 4 6
	56	9	6 7 0
	55	3	7 6 0
	54	3	6 7 0
	53	7	6 0 0
	52	3	6 11 6
	50	3	6 16 6
	21	10	4 12 0
	15	7	4 1 0
West Basset	73	1	4 6 6
	67	5	4 9 6
	65	5	4 16 0
	62	2	5 6 6
	56	5	6 6 6
	52	5	5 1 6
	25	5	5 0 6
Alfred Consols	64	10	3 6 6
	57	8	2 11 6
	55	1, 10	1 5 0
	39	5	3 2 0
	38	1	8 2 6
	37	2	7 16 0
	35	7, 9, 10	3 3 6
Levant	85	1, 5	1 10 6
	82	1, 5	8 18 6
	73	1	5 10 6
	39	5	5 0 6
	2	8	25 5 0
Par Consols	81	1, 5	9 10 6
	70	3	7 11 6
	61	3, 12	6 6 6
Wheal Anna	64	1, 5, 13	7 1 6
	47	12	3 9 6
	44	6	5 11 6
	32	12	1 11 6
	1	5	33 15 0
Tolvadden	55	9	4 4 6
Tolvadden	49	7	£4 6 6
	35	1, 9	3 2 6
	34	7, 8	7 8 6
	4	7	12 18 0
Wheal Margery	50	10, 12	1 17 6
	49	12	7 19 6
	47	10	2 9 6
Copper Hill	49	1	6 15 6
	40	1	2 4 6
	30	1	2 3 6
Treworlis	47	1, 5	3 0 6
	37	1, 5	2 13 6
	10	1, 5	7 2 6
East Rosewarne	47	2	7 7 0
	32	2	7 7 0
	14	5	9 10 0
South Crenver	73	7	1 13 0
	15	9	6 3 0
Wheal Agar	46	6	5 1 6
	38	3, 6	5 12 6
Wheal Buller	57	7	3 10 6
	25	7	10 4 6
	1	8	36 11 0
East Alfred Consols	57	1, 5	3 12 0
	23	1, 5	4 18 6
North Basset	42	1, 5, 9	3 5 6
	24	5	4 2 0
West Trevelyan	35	1, 5	9 16 6
South Carn Brea	27	7, 8	3 11 0
Trannack	24	8	2 7 6
Treffry's Regulus	15	1, 5	10 13 6
Spearn Moor	7	1	16 0 6
Wheal Nelson	7	5	2 7 0
Wheal Prosper	6	5	6 19 0
Pryor's Ore	4	1	5 2 0
Boscaswell	3	1	12 15 0
Pembroke	2	12	1 18 6

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.
East Carn Brea	475	£2,908 10 6
West Basset	400	2,001 8 6
Alfred Consols	325	1,257 14 0
Levant	281	1,511 5 6
Par Consols	212	1,687 12 0
Wheal Anna	188	945 11 6
Tolvadden	177	857 14 6
Wheal Margery	146	600 17 0
Copper Hill	119	486 4 6
Treworlis	94	312 8 0
East Rosewarne	93	713 13 0
South Crenver	88	312 14 0
Wheal Agar	84	447 4 0
Wheal Buller	83	£493 2 0
East Alfred Consols	80	318 9 6
North Basset	66	235 19 0
West Trevelyan	35	343 17 6
South Carn Brea	27	95 18 0
Trannack	24	57 0 0
Treffry's Regulus	15	160 2 6
Spearn Moor	7	112 3 6
Wheal Nelson	7	16 9 0
Wheal Prosper	6	41 14 0
Pryor's Ore	4	20 8 0
Boscaswell	3	38 5 0
Pembroke	2	3 17 0

EACH COMPANY'S PURCHASE.

		Tons.	Amount
1	Vivian and Sons	633½	£3,354 12 8
2	Freeman and Co.	178	1,999 8 0
3	Grenfell and Sons	330½	2,257 11 9
4	Crown Copper Co.	—	—
5	Sims, Willyams & Co.	666½	3,576 8 11
6	Williams, Foster & Co.	109	585 12 6
7	Mason and Elkington	318½	1,430 9 10
8	Bankart and Sons	114½	465 0 0
9	Copper Miners' Co.	231½	£1,227 0 1
10	Charles Lambert	253½	784 16 10
11	Newton, Keates & Co.	—	—
12	Sweetland, Tuttle & Co.	185½	848 2 9
13	Neath Copper Co.	21½	150 18 8
	Total	3041	£15,880 2 0

Average Produce, 6½.
Quantity of Fine Copper, 197 tons 3 cwt.

Average Standard £122 19 0
Average Price per ton 5 4 6

Copper Ores.

Sampled Nov. 5, and sold at the Royal Hotel, Truro, Nov. 20.

Mines.	Tons.	Purchasers.	Price.	Mines.	Tons.	Purchasers.	Price.
Devon Great Consols	146	10	£3 15 6	Marke Valley	43	5	£2 2 0
	137	7, 9	4 14 0		35	10	2 13 0
	130	9	5 1 6		26	5	1 15 6
	129	7	4 12 6	Hingston Down	78	8	3 19 0
	122	3	7 17 0		71	13	3 1 6
	121	3	4 1 6		66	9	3 4 0
	120	1	4 11 6		61	5, 10	2 13 0
	118	8	3 17 0		54	2, 6	6 10 0
	117	11	4 8 0		53	8, 10	2 6 6
	116	1, 5	9 4 6	East Russell	94	5	5 1 0
	115	5	4 6 0		72	5	6 4 0
	108	5	4 16 6		52	2	3 14 6
	101	2	4 9 0		31	1	8 7 0
	99	2	5 1 6	Bedford United.........	110	7, 13	3 14 0
	96	3	9 17 0		98	7, 9	4 5 6
	87	5	7 7 6	Holmbush	52	7	8 1 0
	75	10	2 6 6		51	11	8 8 6
	73	12	2 19 6		50	11, 13	7 5 0
	23	3	9 1 0		47	6, 10	2 11 6
	16	3	18 7 0	Wheal Edward.........	65	8	4 6 6
Great Wheal Martha	112	10	0 12 0		50	9	4 14 0
	110	1, 5	1 3 0		49	10	1 17 0
	96	10	0 14 6		28	6	3 1 6
	81	1, 5, 10	0 14 0	Lady Bertha............	69	7, 10	1 18 6
	74	1	1 5 6		61	7	2 10 0
	48	1, 5	2 6 6		60	7, 10, 13	3 8 6
	25	1, 5	4 5 6	Wheal Friendship ...	90	1	2 18 6
Phœnix Mines	91	5	2 4 0		44	1, 6	10 14 6
	85	8	3 3 0		41	1	10 15 6
	80	12	1 9 0	Kelly Bray..............	47	13	3 18 0
	71	7	3 14 6		40	10	1 3 0
	69	12	3 14 0		39	2	3 17 6
	62	1, 2	7 17 6		29	1	8 8 6
	48	1	4 7 6	Wheal Emma	56	8	3 5 0
East Caradon	123	1, 5, 12	5 0 6		49	1, 5	7 8 0
	91	12	5 3 6		42	1, 5	1 5 6
	90	5	5 3 6	Gawton	89	9	2 5 0
	68	1	11 12 6	Brookwood	67	8	5 4 0
	59	5	10 14 0		15	1, 5	7 4 0
	49	1	10 2 6	Wheal Crebor	66	5, 7	3 16 0
Marke Valley	90	10	3 11 6	Hawkmoor...............	27	8	4 1 6
	87	10	3 3 0	Fursdon	25	5	4 0 0
	80	9	3 14 6	Palamountain's Ore ..	20	1, 12	0 15 6
	79	10	3 3 0	Collacombe	17	1	2 6 0

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.		Tons.	Amount.
Devon Great Consols......	2,049	£10,938 8 0	Wheal Friendship	175	£1,176 18 6
Great Wheal Martha......	546	632 16 6	Kelly Bray	155	604 15 0
Phœnix	506	1,801 19 6	Wheal Emma	147	598 3 0
East Caradon	480	3,472 13 6	Gawton...........................	89	200 5 0
Marke Valley	440	1,371 17 0	Brookwood	82	456 8 0
Hingston Down	383	1,373 10 0	Wheal Crebor..................	66	250 16 0
East Russell	249	1,373 13 0	Hawkmoor	27	110 0 6
Bedford United	208	825 19 0	Fursdon	25	100 0 0
Holmbush	200	1,331 16 0	Palamountain's Ore	20	15 10 0
Wheal Edward	192	692 17 6	Collacombe	17	39 2 0
Lady Bertha	190	490 16 6			

EACH COMPANY'S PURCHASE.

	Tons.	Amount.		Tons.	Amount.
1 Vivian and Sons............	863½	£5,027 9 3	9 Copper Miners' Co	532½	£2,135 12 6
2 Freeman and Co.	349	1,716 6 6	10 Charles Lambert	1001½	2,369 7 9
3 Grenfell and Sons	378	2,898 2 6	11 Newton, Keates & Co...	193	1,125 14 6
4 Crown Copper Co..........	—	——	12 Sweetland, Tuttle & Co.	364	1,273 3 6
5 Sims, Willyams & Co. ...	1181	5,554 19 3	13 Neath Copper Co.	218	834 17 6
6 Williams, Foster & Co....	100½	558 1 3			
7 Mason and Elkington ...	542½	2,351 3 9	Total	6246	£27,858 4 6
8 Bankart and Sons	522½	2,013 6 3			

Average Produce, 5½.
Quantity of Fine Copper, 358 tons 18 cw

Average Standard £125 10 0
Average Price per ton............ £4 9 0

Copper Ores.

Sampled Oct. 8, and sold at Swansea Oct. 28.

Mines.	Tons.	Produce.	Purchasers.	Price.	Mines.	Tons.	Produce	Purchasers.	Price.
Bersharen	122	11¾	3	£9 18 0	Victor Emanuel ..	39	7⅜	3	£6 8 6
	90	11¾	5	10 0 6		22	5⅝	3	4 10 0
	122	10⅝	5	8 17 6	Mount Rose	37	28⅞	2	25 5 0
	116	11	9	9 6 6	Bampfylde	32	20¼	6	17 14 0
	101	10½	5	9 0 0	Lochwinnoch ...	26	10½	11	9 1 6
Knockmahon ...	98	11	1, 7	9 9 6	British Regulus ..	20	29½	14	25 9 0
	91	11⅛	7	9 11 6	Wheal Maria......	10	22½	14	19 16 0
	65	9½	1	7 17 6	Precipitate	10	56⅝	6	47 10 0
	59	11¾	7	10 3 0	London	10	15½	14	13 7 6
	99	5½	5, 6	3 17 0	Cuba	4	66½	6	55 0 0
Valencia	75	25½	1, 13	21 0 0	Bathurst............	4	22⅞	15	13 19 0
	69	24¾	15	20 15 0	Ballycummisk ...	34	7⅜	11	6 8 0
New Cornwall ...	67	21¾	2	19 1 0		26	17⅜	7	15 5 0

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.		Tons.	Amount.
Bersharen	551	£5,183 10 0	British Regulus	20	£509 0 0
Knockmahon	412	3,291 15 0	Wheal Maria	10	198 0 0
Valencia	144	3,006 15 0	Precipitate	10	475 0 0
New Cornwall	67	1,276 7 0	London..........................	10	133 15 0
Victor Emanuel	61	349 11 6	Cuba..............................	4	220 0 0
Mount Rose	37	934 5 0	Bathurst	4	75 16 0
Bamfylde	32	566 8 0	Ballycummisk..................	60	614 2 0
Lochwinnoch	26	235 19 0			

EACH COMPANY'S PURCHASE.

	Tons.	Amount.		Tons.	Amount
1 Copper Miners' Co.	150½	£1,763 13 0	10 Bankart and Sons	—	—
2 Freeman and Co............	104	2,210 12 0	11 Charles Lambert	60	£453 11 0
3 Grenfell and Sons	183	1,557 7 6	12 Ravenhead Copper Co. ...	—	—
4 Crown Copper Co.	—	—	13 Sweetland, Tuttle & Co.	37½	787 10 0
5 Sims, Willyams & Co. ...	362½	3,084 11 6	14 Jennings and Co.............	40	840 15 0
6 Vivian and Sons............	95½	1,451 19 6	15 Neath Copper Co.	73	1,507 11 0
7 Williams, Foster & Co....	225	2,330 19 0			
8 British and For. Copper Co.	—	—	Total........................	1448	£17,070 3 6
9 Mason and Elkington ...	116	1,081 14 0			

Sundry Copper Ore Sales.

Date.	Mines.		Tons.	Price per ton. £ s. d.	Purchasers.	Amount of Money. £ s. d.
Oct. 21.	Parys Mines	Lot 1	200	... 6 0 9 ...	C. Lambert, Mona Co.......	2418 12 0
		2	112	... 6 1 0 ...	J. Keys and Son, Mona Co.	
		3	220	... 2 8 6 ...	J. Radley, jun., Mona Co.	
„ 29.		Lot 1	74	... 20 14 6 ...	C. Lambert......................	19148 7 6
		2	74	... 20 14 6 ...	ditto	
		3	74	... 20 8 0 ...	ditto	
		4	74	... 20 8 0 ...	ditto	
		5	73	... 20 2 0 ...	ditto	
		6	73	... 20 2 0 ...	ditto	
		7	16	... 19 12 6 ...	ditto	
		8	52	... 21 8 6 ...	J. Bibby and Sons...........	
		9	52	... 21 10 0 ...	ditto	
		10	9	... 20 3 6 ...	ditto	

Blende Sales.

Date.	Mines.	Tons.	Price per ton. £ s. d.	Purchasers.	Amount of Money. £ s. d.
Oct. 31.	Minera	30 ...	2 10 6 ...	W. Kenrick	274 5 0
	„	30 ...	2 17 0 ...	Vivian & Sons....................	
	„	15 ...	1 10 0 ...	W. Kenrick	
	„	25 ...	3 13 0 ...	Vivian & Sons....................	

Copper Ores.

Sampled Oct. 29, and sold at Swansea, Nov. 18.

Mines.	Tons.	Produce.	Purchasers.	Price.		
Cuba	103	11⅜	3	£9	16	0
	100	11⅜	5	9	17	6
	11	61	5	49	7	6
	98	11⅛	15	9	16	0
	97	11⅝	1	9	15	6
	95	11⅛	1	9	15	6
	5	22⅛	5	19	9	0
	60	19⅞	8	17	0	0
	59	19⅝	3	17	0	0
(Precip., A.V.F.)	4	81⅛	6	68	10	0
Berehaven	95	11⅛	10	9	14	6
	75	11⅛	2	9	16	0
	110	10⅛	2	8	15	6
Laxey	103	6¼	3	£5	6	0
	67	4½	3	3	6	0
La Ventura......	95	19⅝	1	16	10	0
Nth. Schull Bay	44	1⅜	6	0	19	0
Schull Bay......	11	6⅜	6	5	10	0
	3	18½	10	16	7	6
Mount Gabriel...	23	4⅛	5	3	5	0
Bampfylde	34	19⅛	6	16	10	0
Kanmantoo	13	44	9	37	18	6
West Kame......	13	4⅛	6	3	3	0
Worthing Reg...	61	54	10	45	12	0
	26	54⅛	9	45	18	0

TOTAL PRODUCE AND VALUE.

	Tons.	Amount.		
Cuba	632	£7,771	9	6
Berehaven	280	2,624	2	6
Laxey	170	767	0	0
La Ventura......................	95	1,567	10	0
North Schull Bay	44	41	16	0
Schull Bay	14	109	12	6
Mount Gabriel	23	£74	15	0
Bampfylde	34	561	0	0
Kanmantoo	13	493	0	6
West Kame	13	40	19	0
Worthing Regulus	87	3,976	10	6

EACH COMPANY'S PURCHASE.

	Tons.	Amount.		
1 Copper Miners' Co.	287	£3,444	6	0
2 Freeman and Co.............	185	1,700	5	0
3 Grenfell and Sons	392	3,799	8	0
4 Crown Copper Co.	—	—		
5 Sims, Willyams & Co.......	139	1,702	12	6
6 Vivian and Sons	106	978	5	0
7 Williams, Foster & Co. ...	—	—		
8 British and For. Copper Co.	—	—		
9 Mason and Elkington ...	39	1,686	8	6
10 Bankart and Sons	159	£3,756	2	6
11 Charles Lambert	—	—		
12 Ravenhead Copper Co....	—	—		
13 Sweetland, Tuttle & Co.	—	—		
14 Jennings and Co.	—	—		
15 Neath Copper Co.	96	960	8	0
Total	1405	£18,027	15	6

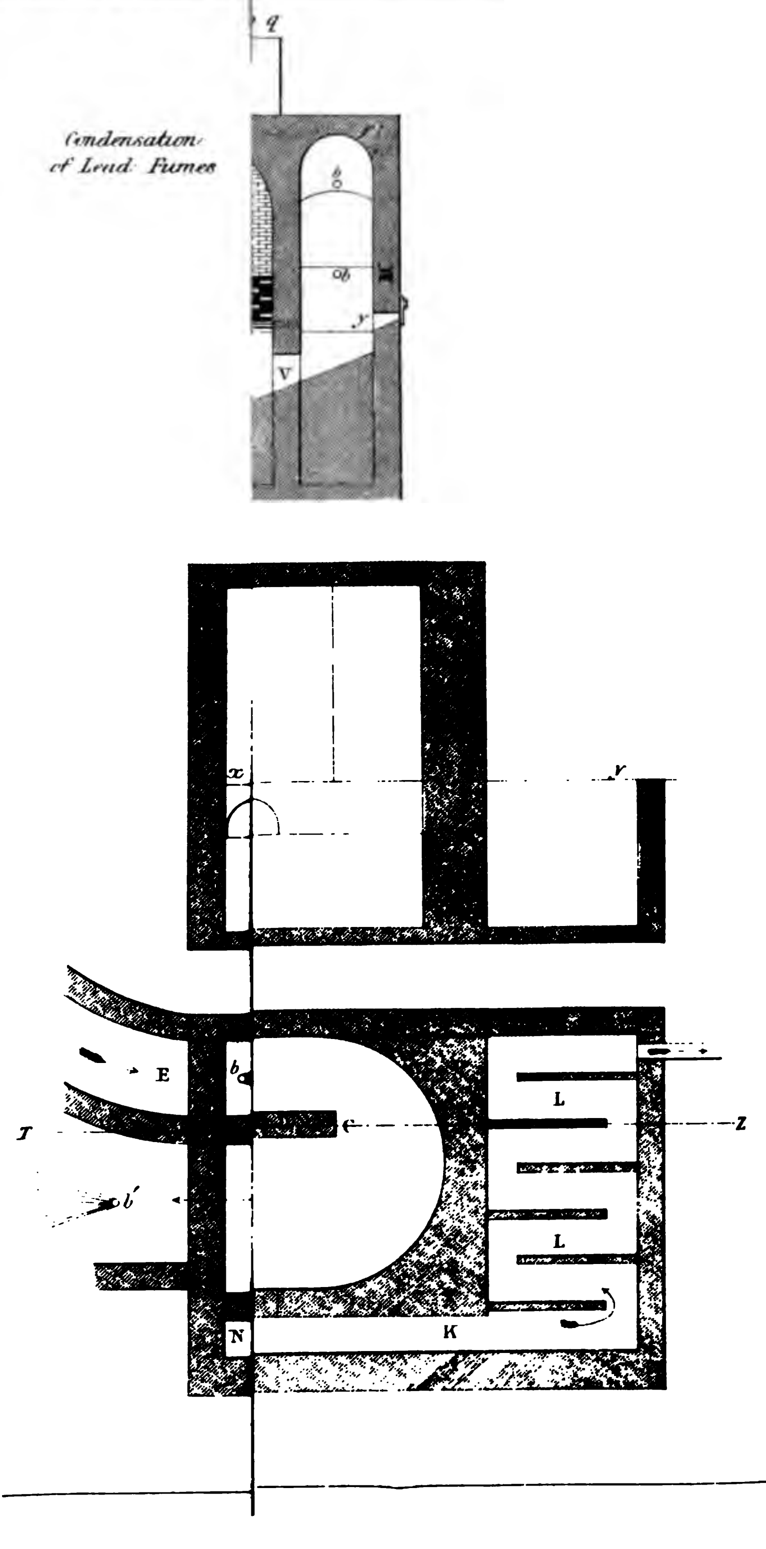
Black Tin Sales.

Date.		Mines.	Tons.	c.	q.	lbs.	Price per ton £	s.	d.	Purchasers.	Amount of Money. £	s.	d.
Oct.	18.	Leeds and St. Aubyn	3	16	3	18	66	0	0	Chyandour Co.	253	16	0
,,	22.	St. Day United.........	10	8	2	19	61	0	0	ditto	1262	13	0
		,, ...	10	5	1	7	61	0	0	Bissoe Co.			
,,	24.	,, ...	14	15	2	2	61	0	0	Trethellan Co.	901	6	7
,,	25.	East Grenville	4	0	2	23	71	15	0	—	289	10	7
		Basset and Grylls......	15	2	1	5		—		—	1060	12	2
,,	27.	Great Wheal Busy ...	15	3	1	8		—		Trethellan Co.	934	15	0
,,	28.	Great Wheal Fortune	36	2	2	20	76	15	0	Mellanear Co.	4043	8	0
		,, ...	12	9	0	19	76	15	0	—			
		,, ...	3	16	3	6	81	15	0	—			
,,	30.	Wheal Hearle	5	7	1	11	68	0	0	—	—		
		St. Just United.........	3	4	0	0	74	0	0	Chyandour Co.	605	10	6
		,, ...	3	4	0	0	74	0	0	ditto			
		,, ...	1	18	0	27	69	0	0	ditto			
Nov.	1.	Wheal Prospidnick ...	4	8	2	4	68	0	0	—	317	4	6
		,, ...	0	7	1	13	44	0	0	—			
,,	4.	East Grenville	2	18	3	16	71	15	0	—	282	1	9
		,, ...	1	2	2	18	62	10	0	—			
,,	10.	Wh. Kitty (St. Agnes)	13	6	1	16		—		—	894	10	3
		New Birch Tor.........	8	8	3	12		—		Enthoven and Sons	591	0	0
,,	13.	Great Work	21	17	1	8	74	15	0	Mellanear Co.	1634	9	8
,,	15.	Great Wheal Fortune	25	2	3	25		—		Chyandour Co.	1870	11	0
		Basset and Grylls......	24	17	0	20		—		—	1604	5	9
		Gurlyn	6	16	1	19		—		—	433	2	6
		North Basset...........	2	9	3	22	66	15	0	—	166	14	0
,,	20.	West Beam..............	10	0	0	0	71	0	0	—	710	0	0
		Penhalls	4	19	1	12		—		—	334	1	9

Lead Ore Sales.

Dates.		Mines.	Tons.	Price per Ton. £	s.	d.	Purchasers.	Amount of Money. £	s.	d.
Oct.	22.	Laxey	100	17	11	0	Walker, Parker & Co.	1755	0	0
		Newtownards	70	13	3	0	ditto	920	10	0
„	23.	Brynambor	10	13	6	0	Sims, Willyams & Co.	133	0	0
		Maesysafn	50	13	1	6	Walker, Parker & Co.	653	15	0
		Mount Pleasant	13	12	15	0	Newton, Keates & Co.	165	15	0
		Hendre Ucha	15	13	4	6	Walker, Parker & Co.	346	12	6
		„	10	14	16	6	ditto			
		Bryngwyn	6	13	13	0	ditto	81	18	0
		Pennant	7	13	0	0	Newton, Keates & Co.	273	2	6
		„	9	13	12	6	Walker, Parker & Co.			
		„	4	14	17	6	Newton, Keates & Co.			
		Roman Gravels	35	13	11	0	Walker, Parker & Co.	474	5	0
		Park	33	13	13	6	ditto	144	18	6
„	24.	Cwmbrane	20	12	13	0	——	253	0	0
„	27.	East Logylas	45	12	18	0	Walker, Parker & Co.	580	10	0
		Glogfach	60	16	1	0	ditto	963	0	0
		Cwmystwith	50	13	4	6	ditto	1315	0	0
		„	50	13	1	6	Panther Co.			
„	31.	Minera	50	13	6	0	Newton, Keates & Co.	7528	15	0
		„	50	13	6	0	Sims, Willyams & Co.			
		„	100	13	10	0	Newton, Keates & Co.			
		„	50	13	6	0	ditto			
		„	50	13	6	0	Sims, Willyams & Co.			
		„	40	13	2	6	Newton, Keates & Co.			
		„	110	13	9	0	Sims, Willyams & Co.			
		„	100	13	9	0	ditto			
		„	14	11	17	6	Walker, Parker & Co.			
Nov.	3.	South Exmouth	85	13	2	6	Panther Co.	1115	12	6
„	5.	Dyliffe	70	13	13	6	Walker, Parker & Co.	1703	17	6
		„	55	13	11	6	Newton, Keates & Co.			
		Llanerchyraur	25	14	3	6	ditto	354	7	6
		Dyfngwm	20	13	6	6	Walker, Parker & Co.	658	14	6
		„	29	13	10	6	ditto			
		Rhoswydol	9	12	17	6	ditto	115	17	6
		Llanfyrnach (Pembroke)	30	14	14	0	Sims, Willyams & Co.	523	0	0
		„	10	8	4	0	Panther Co.			
„	6.	Wheal Mary Ann	60	28	5	0	Treffry's Trustees	2479	0	0
		„	32	12	5	0	ditto			
„	7.	Frank Mills	50	12	8	0	Treffry's Executors	1504	0	0
		„	40	11	1	0	ditto			
„	8.	West Chiverton	60	19	7	6	R. Michell & Son	1162	10	0
„	10.	Frongoch	120	12	10	6	Walker, Parker & Co.	1503	0	0
		Cefn Brwyno	51	13	7	6	ditto	682	2	6
		East Darren	80	16	0	0	Stock and Co.	1280	0	0
		Cwm Erfin	37	16	10	0	ditto	858	0	0
		„	15	16	10	0	Mining Co. of Ireland			
		Bronfloyd	30	14	1	0	Stock and Co.	421	10	0
		Isle of Man Mining Co.	100	24	2	6	ditto	2412	10	0
„	11.	Cargoll	103	15	10	6	Stock and Co.	1599	1	6
„	12.	Minera Union	7	12	0	6	Newton, Keates & Co.	84	3	6
„	13.	Talargoch (Maesyrerwddu)	58	14	12	6	Walker, Parker & Co.	2344	6	6
		„ (Coetia Llys)	51½	14	10	6	ditto			
		„ „	51½	14	10	6	Adam Eyton			
		Deep Level	8	13	0	0	Newton, Keates & Co.	104	0	0
		Rhosesmor	73	13	18	6	Walker, Parker & Co.	1016	10	6
		Parry's	15	13	10	6	ditto	406	15	0
		„	15	13	10	6	Adam Eyton			
		Bryn Gwiog	60	14	2	0	Walker, Parker & Co.	846	0	0
		Long Rake	30	13	9	0	Adam Eyton	403	10	0
		Grestan	40	13	0	0	Walker, Parker & Co.	520	0	0
		Merllyn	5	12	6	6	ditto	61	12	6
		Tyndrum	52	11	6	0	Newton, Keates & Co.	730	2	0
		„	15	9	10	0	Walker, Parker & Co.			
		Llangynog United	16½	12	18	6	ditto	426	10	6
		„	16½	12	18	6	Newton, Keates & Co.			
		Roman Gravels	30	13	5	6	Walker, Parker & Co.	398	5	0
		Nant-y-lago	7	12	15	0	ditto	89	5	0
		Orsedd	4	13	8	0	Adam Eyton	53	12	0
„	15.	Wheal Hope	6½	16	7	6	R. Mitchell	118	2	0
		„	1½	7	15	6	Treffry's Trustees			

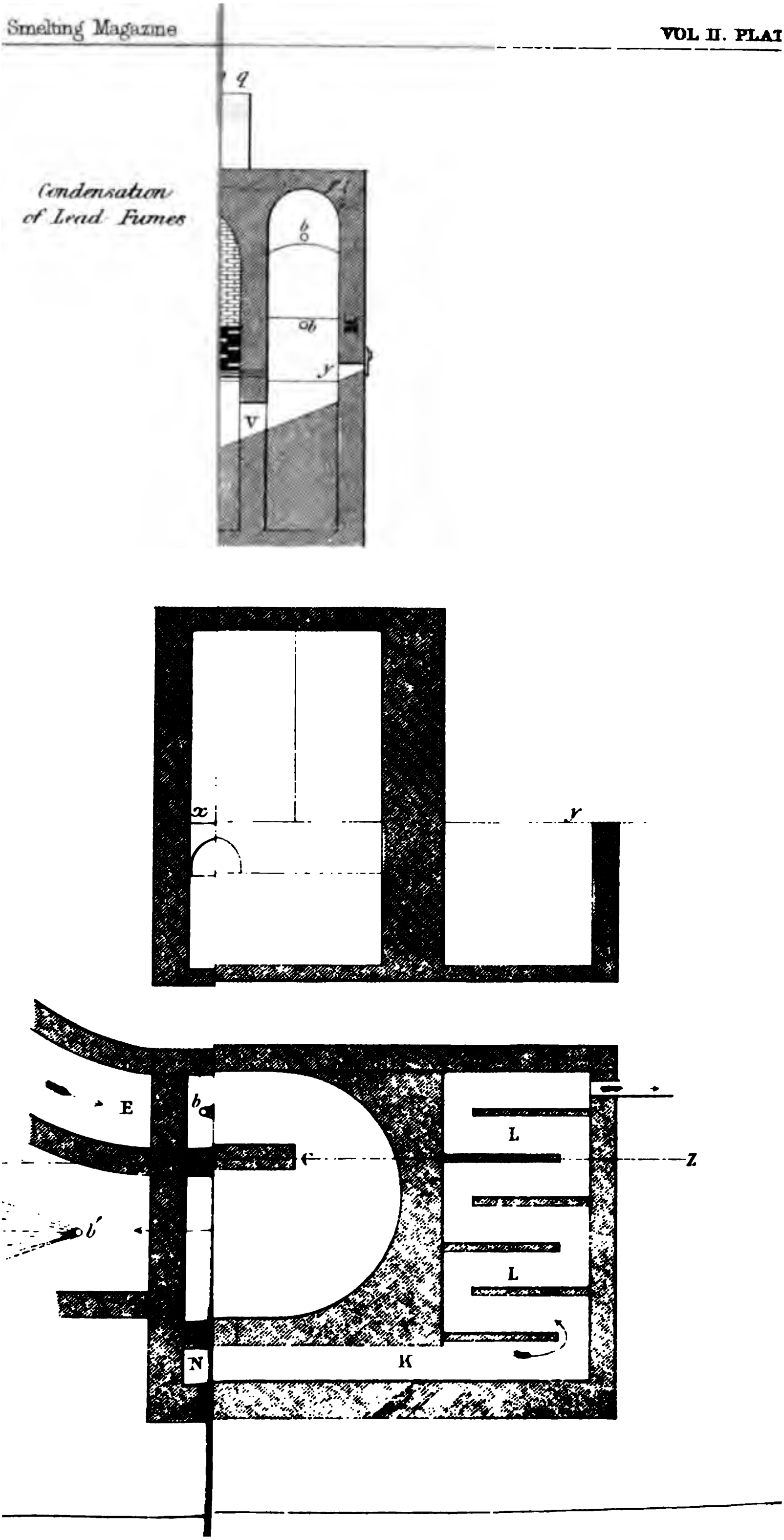
Condensation of Lead Fumes

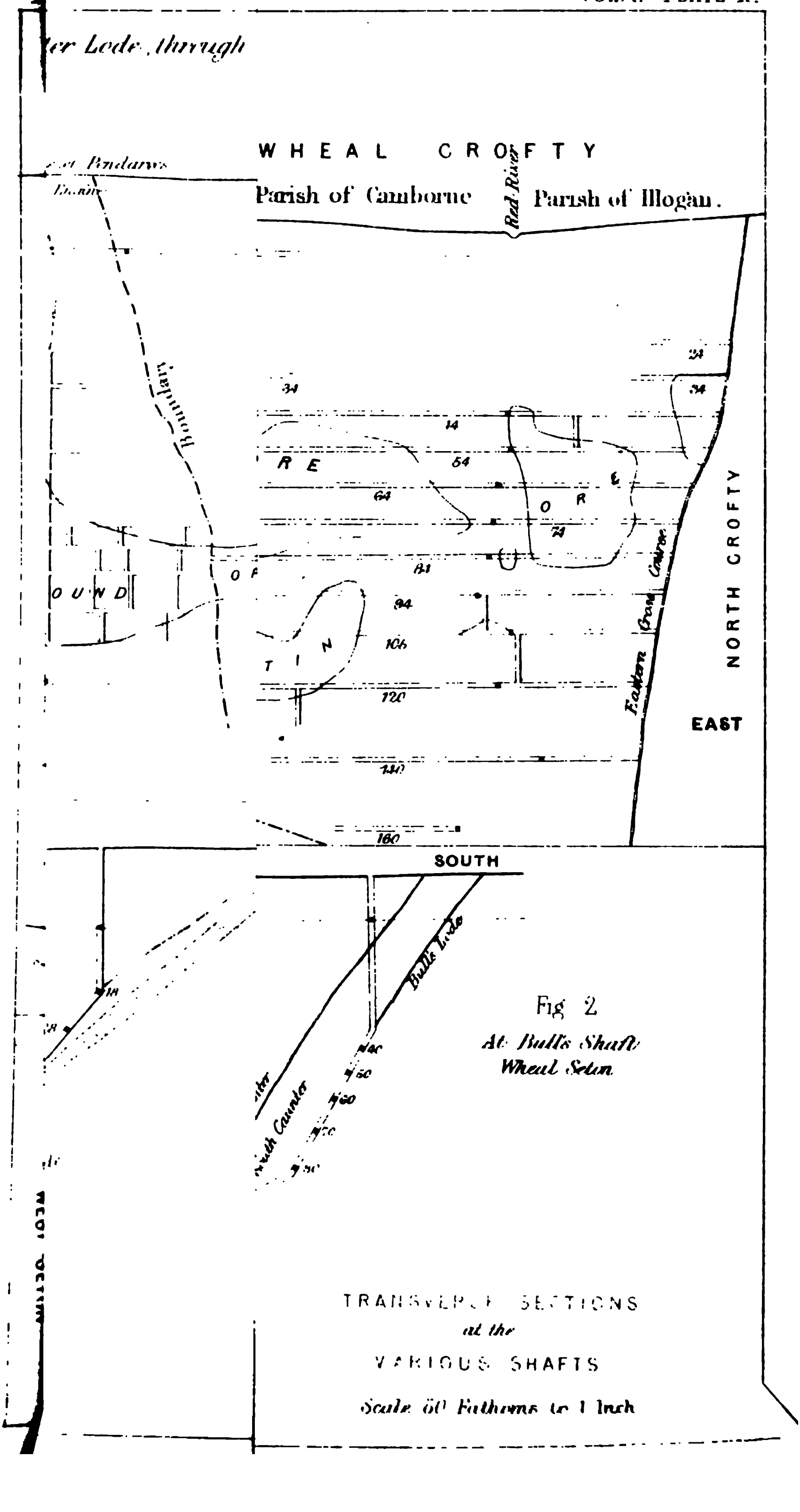


Lead Ore Sales.

Dates.		Mines.	Tons.	Price per Ton. £	s.	d.	Purchasers.	Amount of Money. £	s.	d.
Oct.	22.	Laxey	100	17	11	0	Walker, Parker & Co.	1755	0	0
		Newtownards	70	13	3	0	ditto	920	10	0
„	23.	Brynambor	10	13	6	0	Sims, Willyams & Co.	133	0	0
		Maesysafn	50	13	1	6	Walker, Parker & Co.	653	15	0
		Mount Pleasant	13	12	15	0	Newton, Keates & Co.	165	15	0
		Hendre Ucha	15	13	4	6	Walker, Parker & Co.	346	12	6
		„	10	14	16	6	ditto			
		Bryngwyn	6	13	13	0	ditto	81	18	0
		Pennant	7	13	0	0	Newton, Keates & Co.	273	2	6
		„	9	13	12	6	Walker, Parker & Co.			
		„	4	14	17	6	Newton, Keates & Co.			
		Roman Gravels	35	13	11	0	Walker, Parker & Co.	474	5	0
		Park	33	13	13	6	ditto	144	18	6
„	24.	Cwmbrane	20	12	13	0	——	253	0	0
„	27.	East Logylas	45	12	18	0	Walker, Parker & Co.	580	10	0
		Glogfach	60	16	1	0	ditto	963	0	0
		Cwmystwith	50	13	4	6	ditto	1315	0	0
		„	50	13	1	6	Panther Co.			
„	31.	Minera	50	13	6	0	Newton, Keates & Co.	7528	15	0
		„	50	13	6	0	Sims, Willyams & Co.			
		„	100	13	10	0	Newton, Keates & Co.			
		„	50	13	6	0	ditto			
		„	50	13	6	0	Sims, Willyams & Co.			
		„	40	13	2	6	Newton, Keates & Co.			
		„	110	13	9	0	Sims, Willyams & Co.			
		„	100	13	9	0	ditto			
		„	14	11	17	6	Walker, Parker & Co.			
Nov.	3.	South Exmouth	85	13	2	6	Panther Co.	1115	12	6
„	5.	Dyliffe	70	13	13	6	Walker, Parker & Co.	1703	17	6
		„	55	13	11	6	Newton, Keates & Co.			
		Llanerchyrnaur	25	14	3	6	ditto	354	7	6
		Dyfngwm	20	13	6	6	Walker, Parker & Co.	658	14	6
		„	29	13	10	6	ditto			
		Rhoswydol	9	12	17	6	ditto	115	17	6
		Llanfyrnach (Pembroke)	30	14	14	0	Sims, Willyams & Co.	523	0	0
		„	10	8	4	0	Panther Co.			
„	6.	Wheal Mary Ann	60	28	5	0	Treffry's Trustees	2479	0	0
		„	32	12	5	0	ditto			
„	7.	Frank Mills	50	12	8	0	Treffry's Executors	1504	0	0
		„	40	11	1	0	ditto			
„	8.	West Chiverton	60	19	7	6	R. Michell & Son	1162	10	0
„	10.	Frongoch	120	12	10	6	Walker, Parker & Co.	1503	0	0
		Cefn Brwyno	51	13	7	6	ditto	682	2	6
		East Darren	80	16	0	0	Stock and Co.	1280	0	0
		Cwm Erfin	37	16	10	0	ditto	858	0	0
		„	15	16	10	0	Mining Co. of Ireland			
		Bronfloyd	30	14	1	0	Stock and Co.	421	10	0
		Isle of Man Mining Co.	100	24	2	6	ditto	2412	10	0
„	11.	Cargoll	103	15	10	6	Stock and Co.	1599	1	6
„	12.	Minera Union	7	12	0	6	Newton, Keates & Co.	84	3	6
„	13.	Talargoch (Maesyrerwddu)	58	14	12	6	Walker, Parker & Co.	2344	6	6
		„ (Coetia Llys)	51½	14	10	6	ditto			
		„ „	51½	14	10	6	Adam Eyton			
		Deep Level	8	13	0	0	Newton, Keates & Co.	104	0	0
		Rhosesmor	73	13	18	6	Walker, Parker & Co.	1016	10	6
		Parry's	15	13	10	6	ditto	406	15	0
		„	15	13	10	6	Adam Eyton			
		Bryn Gwiog	60	14	2	0	Walker, Parker & Co.	846	0	0
		Long Rake	30	13	9	0	Adam Eyton	403	10	0
		Grestan	40	13	0	0	Walker, Parker & Co.	520	0	0
		Merllyn	5	12	6	6	ditto	61	12	6
		Tyndrum	52	11	6	0	Newton, Keates & Co.	730	2	0
		„	15	9	10	0	Walker, Parker & Co.			
		Llangynog United	16½	12	18	6	ditto	426	10	6
		„	16½	12	18	6	Newton, Keates & Co.			
		Roman Gravels	30	13	5	6	Walker, Parker & Co.	398	5	0
		Nant-y-lago	7	12	15	0	ditto	89	5	0
		Orsedd	4	13	8	0	Adam Eyton	53	12	0
„	15.	Wheal Hope	6½	16	7	6	R. Mitchell	118	2	0
		„	1½	7	15	6	Treffry's Trustees			

Condensation of Lead Fumes




ter Lode, through
WHEAL CROFTY
Parish of Camborne
Red River
Parish of Illogan.
Boundary
NORTH CROFTY
EAST
Eastern Cross Course
SOUTH
Bull's Lode
South Caunter
Fig. 2
At Bull's Shaft
Wheal Seton
TRANSVERSE SECTIONS
at the
VARIOUS SHAFTS
Scale 60 Fathoms to 1 Inch